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Downs: New Directions for Urban Research  
Allen, Piepmeier, and Cooney: The International  
Technological Gatekeeper

Thurrow: Research, Technical Progress, and Economic Growth



# Technology Review



**DISPOSAL OF  
INDUSTRIAL  
WASTE**

# technology review

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## The First Line

The annual meeting of the American Association for the Advancement of Science is a temporary science-city, of which neither the inhabitants nor the tourists can grasp the whole. The number of simultaneous events, most of the time, is around 25. The impressions of one tourist are therefore unlikely to resemble those of another.

But when I returned from Chicago, I found in the outside world a remarkable unanimity as to what the A.A.A.S. meeting had been like. It had been disrupted by radicals, one of whom had been punctured in retaliation by a matronly knitting-needle.

No doubt *something* was disrupted. I was elsewhere at the time, as was practically everybody else, of course. I was not trying to avoid "the radicals"—any kind of originality is of interest—but they had their priorities and I had mine. Dr. Seaborg, for example, would be adequately publicized without my assistance, I thought, and went in search of greater intellectual stimulation.

I did encounter two unprogrammed distractions. One of Allan Cartter's lectures on the worsening economic plight of universities was preceded by the appearance of a dozen fancy-dress "witches," who delivered an abysmally ill-written curse upon the male-dominated science establishment and then left us to the more frightening attentions of Dr. Cartter (see page 67). And a poorly attended session on the relevant-sounding topic of "human ecology" was rendered almost inaudible by a nearby dance-band. (My initial suspicion that the music had been organized by "the radicals" proved to have been an overestimate of their ingenuity.)

Many participants wore "Science for the People" buttons. "Science for the People" includes as wide a range of attitudes and levels of maturity as do the established political parties. At one end is the vice-squad, devoted to actively pestering those who are deemed immoral; at the other, people whose expertise enabled them to cut through the discussion-period verbiage and induce a

certain degree of realism.

But buttons aside, deeper signs of polarization were few. Indeed, at times it was the dissidents (such as they were) that seemed old-fashioned, repeating last year's slogans while the scholars had been doing their homework and, at a scholarly pace, moving on. One of the solidest "science for the people" proposals came from an economist from Arthur D. Little, Inc. A remarkable satire upon clinical medicine, firmly grounded in research, was presented by a middle-aged Pittsburgh anthropologist, whom the button people would have taken to if they had thought to turn up. Another anthropologist demonstrated that the connection between a culture's technology and its social system is now a legitimate, coherent field of scientific study, which is good news for those who are tired of vociferous guesswork in this vital matter.

I do not suggest that the scientific establishment is the New Atlantis (one could, for example, wish for more evidence of the authentic, life-giving fascination with how nature works); but neither is it the strife-torn mindlessness celebrated in popular mythology—F. W.

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How pulp and paper are made, why the process yields such damaging effluents, and how they may be controlled.

*By David Buhl and Lewis E. Snyder of the National Radio Astronomy Observatory:* Intergalactic space turns out to contain more—and different—things than man can yet account for, or perhaps even imagine.

*By Don K. Price of Harvard's Kennedy School of Government:* The policy under which science flowered after World War II must yield to a new relationship between government and the professions.

# Technology Review

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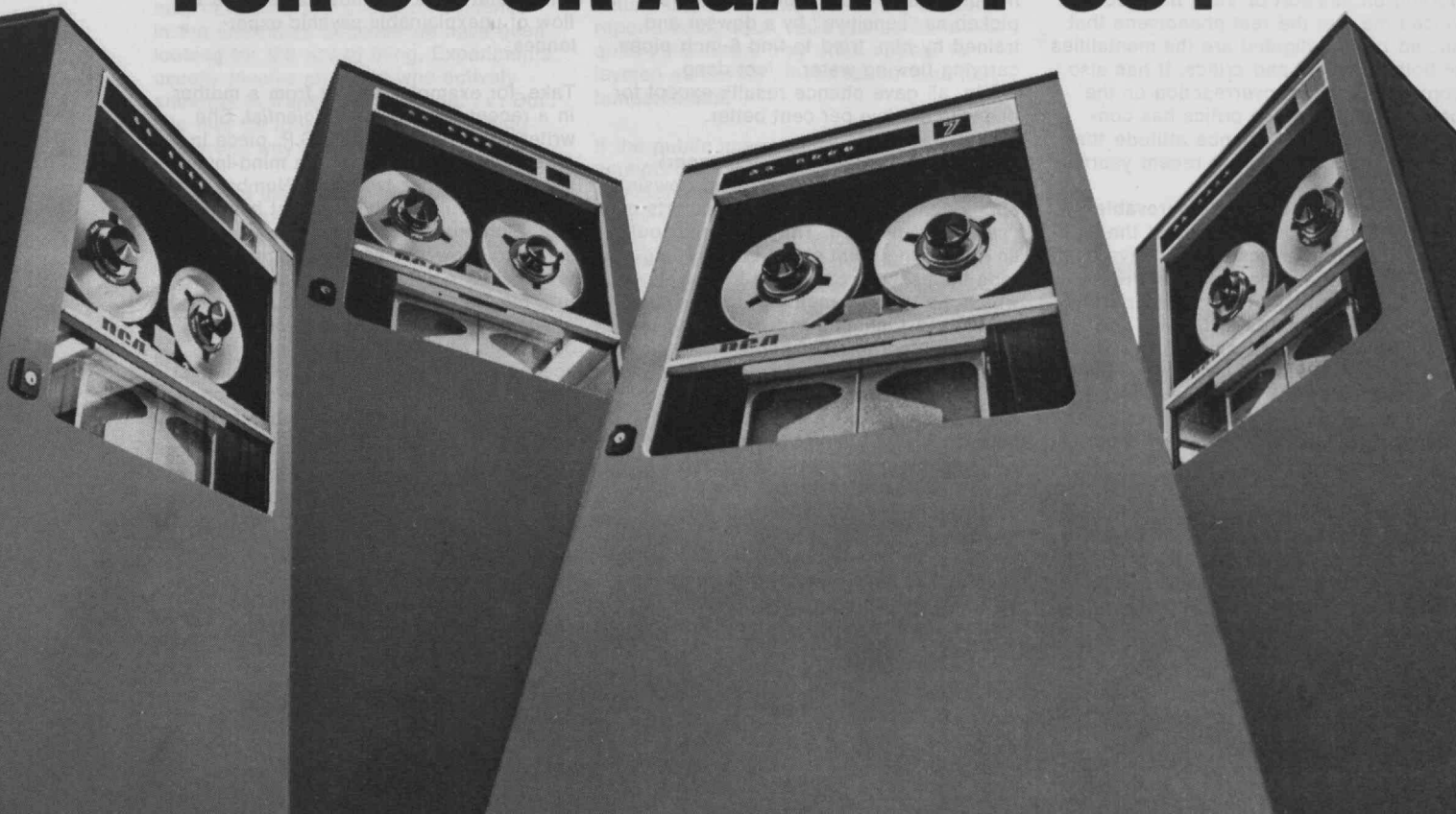
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## ARE THEY FOR US OR AGAINST US?



# Is Your Mind Closed to E.S.P.?

To someone who covered the story of "Henry Gross and His Dowsing Rod," Britain's defense establishment seems a spoil-sport. As some of you may recall, Henry gained fame in the 1950's with an "extraordinary" ability to dowse for water. He not only could find it below ground. He'd ask his dowsing stick questions as to the water's depth and speed of flow. The stick indicated these parameters by dipping a suitable number of times. Henry could carry out such a survey from a map alone. He didn't need to stand upon the site.

Now the British Army and Ministry of Defence have sponsored a rather elaborate set of experiments to test the ability of dowsers—only to find that the results are no better than you could expect from chance.

Too bad. I have an affection for Henry's sort of thing. Along with flying saucers and Immanuel Velikovsky's theories of geologically recent planetary collisions, it was part of my introduction to the scientific fringe world of far-out phenomena—a world which intrigues laymen and infuriates much of the scientific establishment. Twenty years of reporting on this sort of thing have convinced me that the real phenomena that should be investigated are the mentalities of both believers and critics. It has also convinced me that overreaction on the part of some of these critics has contributed to the anti-science attitude that has become prominent in recent years.

## The Legend Is Not Really Disprovable

More of this later. First, some of the highlights of the British tests. They have been reported in the journal *Nature* by R. A. Foulkes of the Institute for Industrial Research and Standards in Dublin. The dowsers, experienced and inexperienced, used forked sticks and L-shaped rods. In several disparate tests, they looked for buried objects—mines, concrete blocks, or pieces of wood—and water flowing in buried pipes.

In one test, eight men experienced in the art tried to detect buried mines by passing their rods over maps of the burial site. Fifty staffers of the British Military Engineering Experimental Laboratory meanwhile looked over the maps and

"In(such) fringe areas of research (as) E.S.P., scientists have a wonderful public relations opportunity to help improve (their) image. . . . Here is an opportunity to convey the spirit of inquiry, of intelligent curiosity, that really characterizes science."

tried to guess the mines' locations. They did as well as or better than the dowsers. But Mr. Foulkes judges none of the results as better than pure chance.

On another test site, 22 expert dowsers searched for objects in an area divided into 400 squares each 20 feet on a side. Some contained buried but inert metal and plastic mines; some had concrete or wooden "placebos"; some were empty. Dowsers used many types of rods, including some of wood or nylon. One used a plumb bob. They dowsed at the center of each square. None did much better than chance.

In water dowsing tests, a buried plastic pipe carried water whose flow could be controlled by an unseen (to the dowser) stopcock. A dowser with a V-shaped rod passed over the pipe in two series of tries for a total of 50 results. Water flowed during half of the tries. The dowser correctly judged the water to be flowing in nine cases of the 25. When the water was turned off he was right 16 out of 25 times. Mr. Foulkes calls these results entirely consistent with chance guessing.

In other water tests, student officers, picked as "sensitive" by a dowser and trained by him, tried to find 6-inch pipes carrying flowing water 4 feet deep. Again, all gave chance results except for one who did five per cent better.

So after a rather hard try, the experiments found no real evidence of dowsing ability either in acknowledged experts or "sensitive" novices. They did bring out an interesting point about the dowsing rods themselves. Some are forked sticks which dip when something is detected. Others are L-shaped rods with their short legs mounted on ball bearings. They swing together when something is found. Mr. Foulkes notes that both types of rods are held so as to be in unstable equilibrium. A slight movement of the hands will start them swinging. In the case of L-rods, no restoring torque can be applied. And it is hard to apply it with V-rods.

Mr. Foulkes says very slight movements of the hands thus produce spectacular motion. He adds, "This is most noticeable

in the V-rods, and once they start to move they almost seem to become alive in the hands (something dowsers often remark). I think this is the explanation for a large part of the mystery surrounding dowsing."

So much for the legend of Henry Gross. But such negative scientific results won't dampen the enthusiasts. After all, people did find water when they dug where Henry Gross said to dig. And they will go on finding water with dowsers' help. It's all part of the fascination with hidden powers of the mind that has kept interest alive in the larger subject of extrasensory perception (E.S.P.).

## One Mind Drawing From Another

For several decades now, a scattering of experimenters, let alone a lot of Victorian ghost hunters, have tried to pin down this elusive phenomenon. They have investigated mind-reading (often by card-guessing tricks) precognition, and what have you. Such positive results as have been claimed are always marginal, often supported by highly suspect statistics. And the scandal of the field for 35 years has been the failure to get a single scientifically repeatable result. Yet one of the things that fuels continued interest is the flow of unexplainable psychic experiences.

Take, for example, a letter from a mother in a recent issue of *New Scientist*. She writes in response to an E.S.P. piece in an earlier issue to tell of the mind-invading powers of her two sons. Number one son showed them when he first began to talk. Eighteen months later, the younger son also showed these tendencies. She tested their ability at card guessing, getting results she thought much better than chance. She adds, "I have a long list of occasions when they undoubtedly had access to my thoughts. . . . The youngest, now 10, still occasionally breaks in on my thoughts." An overly sensitive mother perhaps. But I doubt anyone could convince her the children don't have unusual abilities.

What, though, of Dr. Ann Faraday, University College (London) research psychologist? She wrote a piece in *The Sunday Times Magazine* last November to tell of cases of mind-reading, including



one by her own analyst. She had been wanting to describe a dream to him when it just vanished from her consciousness. He then showed that, somehow, he had mentally perceived the essence of the dream, and its content came back to her. It later turned out that she had been trying to suppress the dream subconsciously.

The cases she cites suggested that one mind reached into another to take something, not that one mind tried to transmit to another. This, she says, suggests a new way of looking at the telepathy question. She notes that "unconscious wishes are extraordinarily powerful" and that "Jung suggests that the unconscious mind at its deepest level is somehow common to all mankind, pervading everyone." She suggests that "an unconscious wish in the mind of one person might seek gratification . . . by reaching out and identifying with a conscious thought of a similar event already occupying the mind of someone else."

She adds: "These examples do not, in themselves, provide the kind of evidence that will satisfy skeptics that telepathy really exists, but they do suggest that we may have failed to find such evidence in the laboratory because we have been looking for the wrong thing. Experiments usually involve an agent who actively attempts to transmit a message. . . . But this may be looking at the whole thing the wrong way round."

#### **E.S.P. and the Public Image of Science**

And so it has gone for decades in "fringe" areas of science like this. Experiments show negative or inconclusive results. Yet people keep having the far-out experiences, often people who have impressive scientific credentials—impressive, at least, to the layman. It will be the same with the dowsing tests.

I'm making no brief one way or the other for E.S.P. or flying saucers in this column. But I do think the scientific community generally has not taken seriously enough the importance of such topics for the public image of science.

People seem to feel a deep need to have such things explained, or at least taken seriously. There probably are funda-

mental psychological reasons for this. You need look no farther, though, than the fact that people go on reporting E.S.P. experiences and flying saucers to see why the public continues to want an explanation.

Perhaps, too, people hunger subconsciously for horizons beyond earth and the limitations of a purely physical world. Whatever the reasons, the psychological need is there and it's there strongly. For scientists to dismiss such things out of hand or to discourage research into them builds an impression of closed-mindedness. And this adds to the image of the scientist as an inhuman materialist.

Some scientists have gone out of their way to create this image. These are the ones who, acting out of irrational compulsion themselves, have actively abused investigators of flying saucers or E.S.P. or ridiculed such research. But honest skeptics have unwittingly done damage too. Most laymen, as I know from endless conversations, have no feeling for what scientists regard as valid evidence, reliable checking, or safeguards against self-deception in analyzing phenomena and reports of phenomena. When scientists undercut E.S.P. or flying saucer reports using such valid standards in quite valid ways, they often appear to laymen as having closed rather than just honest minds.

If the public image of the scientist were unimportant, these observations would be unimportant too. Unfortunately, that image now seems a major factor in the rising spirit of anti-science, in the discomfort of many agitated students, even in the cutbacks on research support. In these fringe areas of research, like E.S.P., scientists have a wonderful public relations opportunity to help improve that image. I'm not suggesting they rush into research or wax enthusiastic about something they may think invalid. But here are subjects where public interest, even emotional involvement, are guaranteed. What scientists say about them and the manner of their saying it will be noticed.

Here is an opportunity to convey the spirit of inquiry, of intelligent curiosity, that really characterizes science.

Denigration or ridicule is out. They instantly convey a narrow mind. So, too, does apathy. To admit the unknowns, to admit that unexplained things have indeed fascinated people while also explaining the reasons for skepticism, will help establish respect. It's the old principle of dealing seriously with something someone else takes seriously, even though it may seem foolish to you. If this principle had characterized the scientists' side of the E.S.P. or flying-saucer discussions of the past couple of decades, it would have done much to devalue the anti-science currency.



*Robert C. Cowen, who writes regularly for Technology Review, is Science Editor of The Christian Science Monitor currently stationed in London.*



The British House of Commons has left in mid-air an American-style legislative investigation of the British computer industry. The British having built a British giant to fight off the American one, what happens to European cooperation?

# Computers of Many Nations

It was probably the most exhaustive and wide-ranging industrial and professional parliamentary inquiry conducted in public on either side of the Atlantic in many years (excluding the kind dedicated to the proposition that someone has been up to something which should be put a stop to). The inquiry was carried out by subcommittee D of the Select Committee on Science and Technology of the British House of Commons. Once a week for some four months, the subcommittee politely but still very thoroughly publicly probed the policies of the major computer manufacturers, software houses, and users, particularly the government.

The proposal was to study "the prospects for the U.K. computer industry in the 1970's, including the possibilities of international collaboration and the functions of government in this field both as policy maker and user." You could construe that to enable you almost to look at anything, and the committee did.

Pricing policies; education; cooperation between government and industry—or the lack of it; cooperation between European manufacturers; efficiency, inefficiency; why was the government operating more than ten differing payroll programs? If it could be shown to have any bearing at all on the subject matter, the committee was bound to look at it.

Unfortunately, the inquiry was interrupted by an election in which three of the five M.P.'s concerned lost their seats. It remains, then, incomplete. However, there are now signs that a number of M.P.'s, many of them on the benches of the new Government, intend to see that it is completed. And not only because most of the evidence is in.

## Extending the Precedent

Unlike in the United States, there is no long tradition of wide-ranging legislative inquiries in Britain. We do not have separation of powers—legislative and money-voting on one side, administrative on the other. Our governments have generally taken the view that the best place for such probings should be the floor of the House—which means in practice that inquiries seldom take place. (There has been one breach in this line, however. For many years, the activities of the

government itself, specifically its administrative machine, have been subject to inquiry by special committees. With the growth of the nationalized industries in the postwar period, there has correspondingly grown up another type of inquiry, of an industrial nature, of which the best known have been the investigations of the one-customer nuclear power industry.)

The computer inquiry, then, set a precedent, and British parliamentarians are great ones for precedent. Once they have one, they can be trusted to extend it as far and as wide as is at all possible. So through the portals of Room 14 in the Palace of Westminster went government departments, and such major computer users as Imperial Chemical Industries and the Shell Group, as well as almost every British computer company and the local outposts of the American ones, like I.B.M., Digital Equipment Corp., and Honeywell. The last, indeed, has long been advertising itself as "Britain's other computer manufacturer," the other one being not, as you might imagine, I.B.M., but Britain's I.C.L. (International Computers Ltd.).

## What Ever Happened to I.B.M.?

So what ever happened to I.B.M.? What happened was a concerted onslaught, from 1964 onwards, led by our major government department concerned with industry, the Ministry of Technology, and I.C.L. The methods apparently included single-tender ordering where government funds were involved, and an insistence on a price-for-performance differential for American computers of a reputed 25 per cent. The inquiry never got a straight answer on this one; however, it never got a categorical denial, either.

The result was that by 1968 I.B.M.'s share of the U.K. market had fallen to 25 per cent. Not only is the British market the only one in the western world where I.B.M. does not have the lion's share, it is also probably the most competitive market of all, with more companies from more countries fighting it out than anywhere else. This contrasts sharply with the continental Western European situation, where throughout the 1960's I.B.M. had something between 60 and 70 per cent of the market.

In theory, the MinTech exercise was concerned with the protection of home industry. In practice, it was targeted on I.B.M., and I.B.M. was not helped by the fact that Britain was the only major industrial country in which it did not have computer manufacturing plant—an omission now being remedied. Honeywell, by contrast a large-scale employer and manufacturer in Scotland, managed to wring a public statement from the Ministry that the existence of plant and its provision of local employment was enough to assure that it be treated as British wherever and whenever it competed.

## Research and the Computer Industry

You might think from this that the home industry's situation is a healthy one. You would be wrong. An important input to the inquiry was in the form of numerous memoranda from computer users—some from very major users. (For instance, the Shell Group's rate of computing expenditure is of the order of \$100 million a year.) Most of them were committed to I.B.M.; and many had strong views on the subject of the support-British policy. Rolls Royce for instance wrote: "... the major supplier meets no domestic competition and is assisted by the Government, influencing the selection of his equipment in both the public and private sectors. While the aims are desirable this does not produce a company or indeed an industry capable of competing effectively in foreign markets."

And why, you might well ask, should anyone in America conceivably want to know all this? The crux of the matter is really in that last sentence, for the subcommittee inquiry is really part of a much larger debate about the future of the computer industry of Western Europe. The problem is that no European manufacturer has a large enough home market base to enable its research and development to compete with I.B.M.'s. Neither have the home manufacturers had so many space and defense projects to help pick up the tab for advanced technology.

The cumulative effects have been quite staggering, when compared to European possibilities. As far back as 1965, the U.S. government was spending some \$300 million a year on computer research

and development. Half of that went to industry. That half accounted for nearly one-third of the \$500 million American computer research and development expenditure. And of that \$500 million, nearly two-thirds was spent by I.B.M. By contrast, I.C.L.'s research and development expenditure even in 1969 was under \$34 million.

The result is that much of the advanced-technology end of the computer business remains in American hands. But that advanced end is politically crucial and sensitive. It is because politics enter into it that the debate originally began, in the mid-1960's. It was sparked by the refusal of the U.S. State Department to allow the French to purchase a large I.B.M. system for the French nuclear weapons program. The political effects have been felt far beyond France.

France launched *Plan Calcul*, an attempt to develop an indigenous French computer industry on the back of some high-skill French electronic companies, one backed by nearly \$150 million. Germany has been acting like an old-fashioned nationalist, quietly supporting the Siemens computer range. The British response has already been described.

There followed the Common Market's Aigrain Committee proposals. Effectively these are to link the computer industries of Europe—to try to create large supported systems of European design and manufacture by linking the existing manufacturers and by giving them preferential access to the government markets of Europe (though no one really spells that out).

#### No Future for Giants?

This program is not progressing very fast, and for two reasons. One, there is no longer a general technical acceptance in Europe of the concept of the large computer. Though it has long been widely thought that the ability to make large systems encompasses the ability to make small ones, there are many doubts as to whether the large machine has a future. Many people see the future in terms of networks of smaller machines, which would mean the concentration of experience and resources in other areas, particularly communications.

Two—and this is the dilemma of the European companies who have taken part in the discussions—there is the place of I.C.L. in any future Europe-wide computer-producing organization. By the standards of I.B.M. worldwide it may be puny, but by the standards of some of the continental Europeans I.C.L. is a giant. Many seem to be frightened that a get-together would mean the substitution of one dominance for another.

Meanwhile, I.C.L.—just to confuse matters further—has already signed an agreement with Control Data Corporation and with the main spearhead of the independent French effort to pool future development—which should create an effective cross-Atlantic group. Meanwhile,

too, we have another problem on our hands: the much-vaunted European technical cooperation, at least those embodiments of it in which Britain took part, is beginning to fall apart. Everybody seems to believe in it in the general, but not—when it comes to picking up the tab—in the particular. Britain has effectively withdrawn from European space efforts. Its aircraft industry is in dire trouble at home—and its situation in Europe is not much better. There are now just three major European aircraft projects in hand in which Britain has a stake; two of them are military, and the third is the unloved Concorde, the future of which is currently very much in doubt.

Strangely enough, this may have a completely different impact on the prospects for European computer development. A government which seeks to show that it is a 'good European' while its application to join the Common Market is being negotiated needs whatever cards it can pick up. The computer card is really a cheap one when you consider that our share of Concorde's development cost is unlikely to be much below \$1200 to \$1500 million. (Incidentally, this accounts for the considerable suspicion with which we view U.S. estimates of what it might cost to build the S.S.T.; Concorde is not anywhere near as advanced in technology, yet it will cost more than the current U.S. estimates for its rival, even though American wage rates are far higher.)

And now, just to confuse matters even

more, Britain has a change in political ideology to contend with. The government of the day has, it seems, decided to withdraw from industry and industrial involvement as much as possible.

Solution? I have none, at least none which has not been trotted out time after time during the last few years. And nobody expects that if and when subcommittee D meets again it will have any, either.

Perhaps the most interesting words on the subject came from a politician talking to an American technocrat. "Let's exchange headaches," he suggested. "You buy our Concorde, we'll buy your large computers."



Rex Malik is a British writer specializing in computer systems and the technological-social interface; he is a frequent contributor to *New Scientist* and to British television on these topics.

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After a few years of lower budgets and higher costs, there is evidence to suggest that economic and political factors may join to yield a new level of federal support for research and development by 1972

# Dark Clouds with a Silver Lining

The recession in science may be bottoming out. Only a few months ago there was still deep gloom about the prospect of more than a few more bones for science in the federal cupboard. No one foresaw more than a few extra dollars for research and development in the 1972 budget, and there were statements that science officials were settling for a "mere" 6 per cent increase for science in universities.

This was dim news for the campuses. Federal science dollars represent two out of every three federal dollars spent to support higher education. Six per cent would barely cope with inflation and would ignore the colleges' still-growing enrollments and needs. But the watchword in Washington was still "fiscal constraint."

Then things changed. The fall elections and rising unemployment told Mr. Nixon he was in danger, and a snarl of Democrats suddenly became far more interested in the 1972 nomination. The watchwords suddenly became "spur the economy" and to hell with the deficit.

At the same time, one of the administration's most important figures—George P. Shultz, ex-University of Chicago economist (M.I.T., Ph.D. '49) who directs the White House's Office of Management and Budget (the recently expanded budget bureau)—felt some things had to be done about lagging productivity, lest the United States join Great Britain as a technological used-to-was. He did not relish the sight of unemployed engineers and scientists at a time of technological needs. More research and development was his prescription.

Dr. Edward David, Jr., the President's Science Adviser (M.I.T., Sc.D. '50) had happily just realigned his entire staff to mesh with the O.M.B.'s. It was in position to give close advice and help set priorities. Little David and his lieutenants had their shopping lists ready.

In the background was the disturbing chorus: the voices of science's Jeremiahs, led by Dr. Philip Handler, President of the National Academy of Sciences, warning that the country's research and

scholarship were "falling into shambles," that though "the scientific enterprise has not been dismantled" quite yet, "the system is in retreat." This kind of talk was clearly potential ammunition for the White-House-hungry Democrats. And President Nixon heard it.

As a result, the fiscal 1972 budget appeared, and, behold, the increase in future research and development obligations was 7.6 percent (from \$15.5 to \$16.7 billion), compared with a drop in fiscal 1971. The increase in science funding for colleges and universities was 14 per cent (from \$1.653 to \$1.896 million). Both figures were surprising and, in the reaction of Dr. Handler, "startlingly good," indeed "heartening."

A skirmish, maybe even a battle, for the cause of strong science has apparently been won.

## How Much Promise in the Prospect?

But the larger campaign is far from ended. The new money has not yet been appropriated. If appropriated this year, it will not enter the cash pipeline until mid-1972. In other words, it will not really affect campuses, faculties, and graduate students very much until the fall semester of 1972. Some crucial fields, like physics and astronomy, are not greatly affected.

The federal government remains in the business of short-term rather than assured, long-term science funding. Government funding has been moving toward "much shorter" time spans, notes Dr. William F. Miller, Stanford's Vice-President for Research. "Short-term funding affects the quality of research. You tend to propose what you know you can do rather than explore new areas. The opportunity for discovering new ideas is diminished . . . when you have to show results in a year."

This administration also will continue to fund fewer traineeships and fellowships for future Ph.D.'s—in accordance with the feeling that there are too many Ph.D.'s now anyway, and with conservative political philosophy, holding that students should somehow pay or borrow their own way, using federal "guaranteed loans."

There will continue to be fewer relatively unrestricted "bloc grants" to the colleges rather than to individual scientists. There will continue to be a standstill, for the most part, in buildings, big instruments, and facilities.

There is still no clear sign, finally, that the United States or its federal government has what might be called a science policy. The quest for a better policy has been a favorite subject in Washington for months. The search is sometimes dismissed as a mere way of asking: "How can we get more money?" There is a good deal of truth in this charge. Still, the quest is much more. There is simply no way for Washington to be reasonably sure today that it is sensibly using science and technology to help meet national goals.

The Defense Department, whether one thinks it is grossly under- or over-funded, at least spends every dollar (in theory, anyway) toward one purpose: military capability. No apparatus at all exists to examine the science spending of a hundred agencies and ask: Are we maintaining an assured level of effort to collect basic knowledge, then use as much of it as possible for public ends?

## The Quest for Science Policy

As a remedy, an almost frantic Dr. Handler last May called for a new, cabinet-level agency to support both science and higher education, and, as a bonus, end the "artificial division" in universities between the humanities, social sciences, and natural sciences. The idea was met by dead silence. The notion of a cabinet-level Secretary of Science has never been popular among politicians who already control their individual pieces of science. Most scientific leaders, like Dr. Lee DuBridge and Dr. David, his successor, have felt that science is better used and better served as part of the mission of many agencies.

Democratic Representative Emilio Q. Daddario, then Chairman of the House Science Subcommittee, proposed creating the "National Institutes of Research and Advanced Studies" (N.I.R.A.S.) as a "fresh, . . . commonsense, . . . do-able" approach—inco-



porating the National Science Foundation, much of the National Institutes of Health, and the scientific activities of many other agencies into three major institutes (of natural sciences, ecology, and education) as well as a smaller institute of arts, humanities, and social studies and another for social sciences. A N.A.S.A.-size agency of this type, Daddario argued, could win strength and attention for science and be far more effective and economical than its scattered parts.

Handler endorsed this idea, too. No one else paid much attention to it or considered it do-able, although bidding a reluctant goodbye to Daddario, one of the most conscientious men ever to serve in Congress. He left to run for Governor of Connecticut and was defeated.

A Presidential Task Force on Science Policy—headed by Dr. Reuben F. Mettler, head of TRW Inc.—recommended that the President's Science Adviser develop new inputs to help shape science policy, drawing on industry, labor and the professions as well as on university and nonprofit institutions, the traditional founts of wisdom. The Mettler Task Force, which is still alive, also recommended "doubling" the N.S.F. budget to make it a far stronger unit in both science support and policy making.

Something like that could yet happen to the long-starved National Science Foundation, the post-World-War-II creation envisioned by Vannevar Bush as the cornerstone of federal support of science. For years it was weak and underfinanced. Then, for fiscal 1971, President Nixon and Congress moved it from a budget of \$416 million to \$513 million. The President's new budget would hand it \$620 million in fiscal 1972, a 49 per cent increase in two years.

If the N.S.F. continues to grow, much credit will rightly go to the organization's current director, Dr. William F. McElroy, a vigorous, lively fellow. McElroy, like the Mettler Task Force, sees science policy created with the advice of many groups and citizens. But—an instinctive politician as well as a good biologist—he recognizes that "it is the President who ultimately must make the decisions." And, given the present structure, "coordination should rest with the President's Science Adviser."

Enter the Science Adviser, now Dr. David, dubbed "Little David" here out of regard for the way in which this slight engineer has rapidly made it clear that he and his office, backed by P.S.A.C. (the President's Science Advisory Committee, which he chairs), intend to coordinate. He is the conduit to the President and the budgeters. And if he can succeed in coming up with healthy looking budget increases, he can carry off the role like no science adviser since the Kistiakowskys and Wiesners of the 12- to 15-per-cent growth years.

"It is my opinion," he states first of all—freely admitting that "I start from a number of prejudices"—"that the mechanisms for setting a forward-looking science policy already exist in this government." Translation: no super-Department of Science in the offing. This does not mean there could not be new mechanisms, too, say a Mettler-style advisory council adding its voice to P.S.A.C.'s. This possibility was raised by DuBridge last summer. Just for one point, it would be a nice way for a Republican president to create a counter to the advice of the preponderantly Democratic P.S.A.C. (anti-S.S.T., anti-A.B.M., not exactly Mr. Nixon's type of scientists).

"Science policy," Dr. David goes on, "is determined by the interactions of the bureaucracy and the White House, particularly O.M.B. and O.S.T. (Office of Science and Technology)." Translation: we're getting results so far working hand in glove with both the budget makers and the White House guard. DuBridge, for all his ability and prestige, did not furnish initiatives and solutions to the White House staff as nimbly or with the political finesse that it wanted. David found both White House and O.M.B. eager for a Johnny-on-the-spot with answers or alternatives for every contingency, and a science adviser more in tune with their pace and philosophy.

Take David on political philosophy: "Many people believe that the time for stimulating the growth of Ph.D. production is past. . . . There is a school of thought that a continuing expansion of this magnitude is not wise, and traineeships in particular should be cut back or discontinued leaving the Ph.D. production process to so-called marketplace control. Here indeed is a substantive question for science policy." Translation: the White House favors marketplace control.

Here indeed is a red flag for much of the scientific community, including the scholar-Jeremiah, Dr. Handler, who believes fiercely that federal fellowships and traineeships are needed to build human assets for the nation and bring the unwealthy into the system. Men like him fear that an expanding country with a temporary Ph.D. surplus will timidly cut off training now, then face a shortage of several classes of experts in the 1980's. Here is an issue on which Dr. David could founder if wrong.

"A second science policy issue is that of priorities." Here, David promises both strong basic research (see *"Toward New Initiatives,"* by Edward E. David, *Technology Review* for February, pp. 24-27) and strong applied research to back an expanded national health program, to "reform" the educational system, to solve energy problems while preserving the environment, and to "control" the environment.

A Bell Telephone Labs executive until his appointment last August, Dr. David

promises to expand "the area of demonstrations and pilot operations . . . to catalyze the transfer of new technology into the commercial world"—especially where the time for pay-off is long ("ten years or more") and a particular industry is too highly fragmented to do the job.

### A Kitchen Cabinet of the Sciences

Some weeks ago, fearful of another thin science budget, disturbed by the continuing trend toward abandoning fellowships and traineeships and emphasizing loans, disturbed by a drop in unrestricted bloc grants to colleges in favor of specific project grants, Dr. Handler accused this administration, "like" the Johnson administration, of not really giving a high priority to science.

One newspaper reporter then wrote that a conciliatory David, musing on the matter of priorities, envisioned the Academy as a kind of a think-tank to screen new ideas and give O.S.T. and P.S.A.C. its judgment. Handler, in an interview, said that the newspaper story was the first he had heard of this.

The N.S.F., it was also reported, would be the originating point for ideas. Both David and McElroy called this a misconception and said ideas might flow "back and forth." (It is clear there will be no shortage of them from the energetic McElroy.)

The upshot of this exchange, and whatever lay behind it, is that David, McElroy, and Handler are meeting regularly now over lunch, sometimes with other officials, as a kind of new kitchen cabinet of the sciences.

Indeed, David states, the Academy, N.S.F., and O.S.T. could be "a powerful coalition" to keep the new momentum rolling. Whether this coalition will develop or founder is yet to be seen. But men and political reality are more important than organization charts in political Washington. The Nixon administration's strongest element in "science policy" could yet be three men sitting around a table, agreeing and disagreeing and coming to grips with reality.



Victor Cohn, whose report appears regularly in this space, directs the science reporting staff of the Washington Post. At the end of this month he will receive the American Chemical Society's \$2,000 James T. Grady Award for "interpreting chemistry for the public."



The Vietnam crop-destruction program has had no significant effect on enemy food supplies, while clearly contravening the U.S. Army's own rules for the conduct of land warfare

# Herbicides in Vietnam: Juggernaut Out of Control

August 9, 1970, was a bad day for those who have confidence in the beneficent power of science. On that day, American C-123 aircraft sprayed cacodylic acid, a crop-killing chemical, onto rice paddies in a "remote, unpopulated" valley of Quang Ngai province in Vietnam. The military thought the heavily populated valley was chiefly cultivated by Vietnamese to raise food for the Vietcong or North Vietnamese regulars.

But the 14-month-old intelligence upon which this mission was based was all wrong. An independent assessment by distinguished American scientists who have respectful ties with authority uncovered facts about American crop spraying in Vietnam which are more disturbing than the New Left might have imagined. Instead of evidence linking herbicide spraying to congenital malformations—conclusive proof one way or the other is probably impossible to obtain—a commission led by Harvard biologist Matthew Meselson found signs of what an independent observer can only feel is wanton destruction of civilians' food. (For a description of the effects of herbicides on forests and on public health in Vietnam, see pp. 61-62.)

Just 12 days after the crop-destruction flight, Meselson flew over the Song Re valley in a helicopter, escorted by a Col. Galliard, the chemical operations officer of the northern provinces of South Vietnam. Col. Galliard assured Meselson that the raid of August 9 was typical of crop destruction operations and very well planned. He said there were no houses below. Meselson saw no houses either but took many photographs. These photographs, showing hundreds of houses, were a key piece of evidence to explode virtually every military assumption about the purpose and effect of the crop spraying.

Meselson was there as part of a one-month field survey he and three others were making as part of an \$80,000 study of the impact upon Vietnamese plants and people of the massive U.S. herbicide-spraying program in Vietnam. After years of wrangling, the study was ordered by the American Association for the Advancement of Science at its 1969 annual meeting in Boston.

The study is not definitive. It really is an attempt to establish the feasibility of studying herbicide effects before the war ends and thus aid postwar recovery. It aims at opening the door to studies that should—in Meselson's view—be conducted almost entirely by Vietnamese scientists, who are quite capable, with sufficient government support, of doing their own work without the all-too-normal American pushing.

The A.A.A.S. study also opens the door to and defines the problems for a Congressionally ordered study of the problem by the National Academy of Sciences, which presumably will get access to some classified information denied to Meselson.

## An Establishment Show

It must be realized that the study was an "establishment show." Preparations for the survey in Vietnam, which received full cooperation from all authorities in Saigon, included a two-week gathering of leading experts on herbicides—"hawks" and "doves" and neutrals—at Woods Hole, Mass.

During the month in Vietnam, the only hitch in otherwise generous cooperation from U.S. and Vietnamese officialdom was a refusal—almost certainly prompted by the attitude of one or two officials in the Pentagon—to release the logbooks kept in Saigon of the exact times, amounts, places, and types of herbicide spraying.

The A.A.A.S. study was not supposed to consider either the morality or the military efficacy of the spraying, and in giving their reports in Chicago, Meselson and the others from the Herbicide Assessment Commission stayed clear of these issues.

But the issues came up anyway. The first results of the investigation pointed clearly to a herbicide-spraying program undertaken with as little heed for efficacy as the World War II campaigns of destruction against German cities. The vast, intense program in Vietnam showed up as a blind use of a technology ready to hand by a military organization super-endowed with weapons and apparently incapable of conducting rational studies

of what it was doing, and also incapable of paying attention to the results of the few studies which were performed.

The A.A.A.S. commission members could not help seeing what so many other cool observers of the American involvement in Vietnam have seen: a juggernaut out of control, ridden by men suffering from an appalling "cultural mismatch"—to use Meselson's phrase—with a people they were supposedly trying to "save" from communism. The riders of the juggernaut are soldiers on 12-month tours of duty who write many of their reports in Hawaii on the way home. Armed with all but the "ultimate" weapons in an overwhelming arsenal, these soldiers can, with detachment, destroy a country to save it.

The 15-square-mile area of the Song Re valley through which the G-123's passed last August 9 might have appeared to an untutored eye to contain no houses, as Col. Galliard thought. But examination of Meselson's photographs showed even more structures than the 940 shown in a U.S. Army map prepared in 1965 from French data. At an average of six inhabitants per house, there were, conservatively, 5,000 people in the path of the spray planes, living in houses with fresh-appearing thatch (it must be replaced annually) and keeping their fields trim and free of weeds.

Instead of a sharp increase in the amount of cultivated land in the valley—taken by the U.S. military as a sign of cultivation for enemy soldiers—the area cultivated was actually about the same as in 1965.

There was terracing in the valley—taken by the military as a sign that Vietnamese were doing the farming, even though U.S. anthropologists in Saigon confirmed for Meselson's study that the Hre tribesmen, the actual Montagnard inhabitants of the Song Re valley, have practiced terracing for decades.

The Army had thought that the valley's inhabitants might have quit their homes in response to previous, much less extensive, sprayings by helicopter, but they had clung to their land. Thinking the valley uninhabited, the U.S. military

assumed it produced a large surplus of food for the Vietnamese communist forces. In fact, the cultivated area was about enough mountain land to feed the 5,000 inhabitants at a subsistence level.

#### **An Isolated Instance?**

If the spraying in the Song Re valley had been an isolated instance, it might have been dismissed as just another unpleasantness in an unpleasant and unproductive war. But it was not an isolated instance.

Over the past decade, chiefly since 1965, crop-killing chemicals have been sprayed over some 600,000 acres in South Vietnam, destroying, by a conservative estimate, enough food to feed 600,000 people for a year. For four years, crop destruction was proceeding at the rate of 150,000 people's food supplies each year. The amount of herbicide sprayed on to crops amounts to about 10 per cent of the total weight of plant-killing compounds the U.S. has used in Vietnam since 1961.

The brunt of the crop spraying has just happened to fall on to "remote, unpopulated" areas of the Central Highlands of South Vietnam, inhabited by 500,000 or more members of the several dozen Montagnard tribes, who do not speak Vietnamese, or share the religions or physical appearance of the Vietnamese majority. The Montagnards (see p. 61) are minority groups regarded with no special affection by the Saigon government, from whose local representatives emanate formal requests for each spraying operation.

The Montagnards kill their water buffalo after a spray raid, either as propitiatory offerings or out of a mistaken belief that the animals are poisoned. Water buffalo are the chief badge of wealth among the Montagnards.

Driven from their land, forced into refugee camps, deprived of a normal livelihood, the Montagnards now get their rice from the government and presumably no longer pay a small rice tax to nearby Vietcong.

Whether the Montagnards are grateful for this "protection," and thus "won" for the anticommunist cause, may be doubted. The circumstances of the crop spraying point sharply toward utter political failure in a war whose chief goals are political.

Studies by the RAND Corp. and others, still classified, show conclusively that crop destruction simply does not achieve the military purpose ascribed to it: denying food to enemy soldiers. Studies completed as long ago as 1967 show that no more than 1 per cent of the food eaten by Vietcong and North Vietnamese soldiers in South Vietnam comes from that country.

Questioning of enemy soldiers captured in South Vietnam show that their average daily intake of rice varied between 400

and 800 grams. This variation is explained chiefly by distance from Cambodia, the main source, and not explained at all by any local crop destruction program. Despite years of deforestation with herbicides and endless bombing, the food supply system of the Vietnamese communists has not been meaningfully "interdicted."

What is more, crop destruction is continuing in the heaviest-hit Central Highland areas. Meselson was told in Vietnam that the August 9 raid in Song Re valley was just part of a program designed to destroy 15,000 metric tons of food in Quang Ngai and Quang Tin before the end of the 1970-71 harvest season. This would be enough to feed 50,000 to 70,000 people for a year. That is just the number of Montagnards estimated to live in the two provinces. Although the White House announced December 26 that herbicide spraying would be rapidly phased out in Vietnam—perhaps by spring when supplies already in that country could be exhausted—the language of the announcement allowed for continued spraying around the perimeters of Army "firebases" and in "remote, unpopulated" areas.

As of this writing, there is no official confirmation that the crop-killing operations have ceased.

#### **Against the Rule-Book**

After Meselson and two colleagues, Dr. John Constable of the Massachusetts General Hospital and Dr. Arthur Westing of Windham College in Putney, Vt., had presented their reports to the 1970 A.A.A.S. meeting in Chicago, another disturbing aspect of the crop-destruction program came to light: It violates the Army's own rules.

This point was made by Dr. George Bunn, professor of law at the University of Wisconsin and former general counsel of the Arms Control and Disarmament Agency.

To make it, Bunn did not invoke the 1925 Geneva Protocol banning first-use of chemical and biological warfare, which President Nixon resubmitted to the Senate last August 19. Although the U.S. drafted this protocol, the Senate referred it back to committee and never acted. In subsequent years, the protocol became so widely accepted in international law that the U.S. probably would be bound by its terms even without President Roosevelt's unilateral pledge to observe it in 1943, or the final ratification expected sometime this year.

In the early 1930's, the U.S. objected to the British interpretation that the protocol prohibited tear gas along with lethal gases, and today the U.S. holds that the protocol does not cover either tear gas or herbicides. This position was formally stated in a letter from Secretary of State Rogers to President Nixon that went to the Senate along with the treaty. The interpretation in Rogers' letter goes against the opinion of the 80 govern-

ments who voted for a U.N. resolution in December 1969 saying the Geneva protocol does cover tear gas and herbicides.

But instead of relying on the Geneva protocol, Bunn finds that the Army's own field manual 27-10, issued in 1956 and still current, contains clear language ruling out destruction of civilian food supplies.

The manual interprets both the 1907 Hague convention against poisons in warfare and the 1949 Geneva convention governing behavior in occupied territories.

Noting the provisions of the Hague convention, the manual says food crops can be destroyed by harmless chemical or biological agents if they are intended solely for enemy forces and if that fact can be determined.

Although the U.S. does not view itself as an occupying power in Vietnam, the field manual makes it clear that the Geneva convention binding military forces not to destroy nonmilitary property or civilian food supplies is regarded as applying to any areas where troops are passing.

Bunn commented: "It seems clear from the Herbicide Assessment Commissions' report here today (December 29, 1970) that the United States cannot show that all the crops destroyed by herbicides in Vietnam were intended solely for consumption by enemy armed forces.

"The continued use of herbicides to kill crops intended for civilians would seem to violate the rules of land warfare as understood by the Army itself."

Bunn gently pointed out that charges of needless destruction or denial of food supplies to civilians were included in the war crime indictments at Nuremberg and in Japan after World War II.

The crop destruction program's uselessness and destructiveness did not receive enough public attention at the Chicago meeting. It is a serious example of applied science out of control. It is worth noting that the first objective examination of the subject was performed by scientists.



*Victor McElheny, who contributes regularly to Technology Review, is Science Editor of the Boston Globe.*

Just a year after their first conference, the scientists who have received lunar samples returned to Houston for a second review of what they found and what it means. Though the evidence is still sparse, one of the scientists told Peter Gwynne that "we begin to see something about the basic way in which the moon has been put together . . ."

# Toward a History of the Moon

Six months after Neil Armstrong and Buzz Aldrin landed at Tranquility Base, some 140 scientific teams who had studied the lunar samples gathered there assembled in Houston to tell the world what the moon was really like. The result was a three-ring circus in which theories were dreamed up in a minute and knocked down just as fast, descriptions were often incomplete owing to the short time available for the work, and confusion was the predominant theme (see *Technology Review for February, 1970, pp. 16-17*). In January of this year, the lunar scientists tried again. And this time, at the Second Lunar Science Conference, there were clear signs of progress in understanding the nature and evolution of the moon. "We are starting to do science," declared University of Oregon chemist Gordon Goles. "We begin to see something about the basic way in which the moon has been put together as a planet."

The scientists gathering at this year's meeting had gained two distinct advantages since the first lunar conference: more time and more material. Most of the descriptive work was based on the total 122.6 pounds of rocks and soil collected by the Apollo 11 and 12 crews from the Sea of Tranquility and the Ocean of Storms. But the meeting was also able to attract a notable scientific coup—a Russian report by Aleksandr P. Vinogradov, Vice President of the Soviet Academy of Sciences, on preliminary studies with the three ounces of soil from the Sea of Fertility returned to earth by the unmanned Luna 16 last September.

While any lunar scientist worth his basalt will agree that, when it comes to moon rocks the catchphrase is the more the merrier, the availability of samples from three separate areas of the lunar surface is not quite as significant as it might at first appear. For while lunar experts now recognize that the moon is, in geological terms, a complex planet, all three samples come from geologically similar areas. Indeed, "the lunar rocks of the three seas are of the same general type," summarized Vinogradov. Trying to decode the moon's past using the current three samples is thus not unlike trying to describe the earth using only three samples of the ocean bottom.

## "Exotic Fragments" in the Soil

Nevertheless, the samples have not been without their share of mysteries. One of the first arose from the Apollo 11 collection when it became clear, from rubidium-strontium dating, that the soil in the sample, with an age of some 4.6 billion years, was much older than the rocks, which admitted only to 3.7 billion years. To add to this particular puzzle, lunar scientists discovered that, no matter how they ground up the Apollo 11 rocks, they could not produce from them soil of the same composition as the soil samples actually gathered at Tranquility Base.

The Apollo 12 samples confirmed the mystery; the only difference was the minor point that the rocks from the Ocean of Storms were younger than those from the Sea of Tranquility, with an age of 3.3 billion years—but they also held the germ of the solution to the puzzle.

Slightly less than a year after the Apollo 12 samples were gathered, teams at the Manned Spacecraft Center and the Smithsonian Astrophysical Observatory identified in the soil what they termed "exotic fragments"—pieces of material obviously different in chemical make-up from the basalts that predominate in the mare material. It soon transpired that these fragments—dubbed KREEP by the M.S.C. team because of the characteristic richness in potassium (K), rare earth elements (REE), and phosphorus (P), and named more simply "norite" by the Smithsonian group—might actually be the "magic components" necessary to explain the discrepancies between the mare rocks and soil. For one thing, the fragments appeared very old; thus the measured age of the mare soils could be explained as the result of measuring two types of soil of different ages, with the KREEP or norite, which makes up 30 per cent of that soil, biasing the result.

Further, the fragments were obviously foreign to the mare surface, which neatly accounts for the scientists' inability to produce mare soil by grinding up the rock samples from Apollo 11 and 12. And indeed, many lunar experts at Houston expressed the belief that the fragments of KREEP and norite represented samples of the moon in its earliest years.

"We think," said John Wood of the Smithsonian Astrophysical Observatory, "that they represent the near surface material in the ancient lunar crust that existed before the mare basins were filled."

In addition to solving new mysteries, the Houston conference produced much evidence to confirm earlier work. Thus, continued chemical analysis of the lunar rocks appeared to add further evidence that the moon lacks water now and has almost certainly been without it in the past. According to M.I.T.'s David Wones, the lunar rocks are thousands and perhaps millions of times drier than the driest deserts on earth. "If anyone's going to set up a base on the moon, they're going to have to take their water with them," commented Wones.

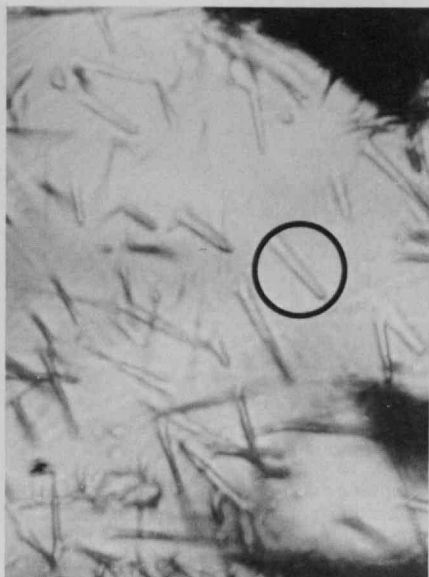
The lack of water has inevitably influenced many of the geological processes that have taken place on the moon. For example, the lunar interior, with no water to lubricate it, is probably stronger than the earth's, while the range of mineral deposits on the moon is probably smaller than was once anticipated by optimists looking for financial fall-out from the lunar venture. "It's a little bit discouraging," declared Eugene N. Cameron, an economic geologist from the University of Wisconsin. "It doesn't seem that we will have much of a variety of mineral deposits on the moon."

## Tracks and Earthquakes

Yet while potential lunar prospectors may be disappointed by the results so far, scientists are not. One of the most exciting—and controversial—discussions at Houston concerned the existence on the moon of exotic particles, such as long-extinct radioactive elements and super-heavy elements, that do not exist on earth, as well as the magnetic monopole, the magnetic equivalent of the point electric charge that has so far defied all searches for it. The evidence, such as it was, came from studies of cosmic ray tracks which exist in the Apollo samples in great profusion.

A team from the Tata Institute in Bombay, India, led by Dr. N. Bhandari, reported the existence of tracks which they believed could only have been left by a dis-





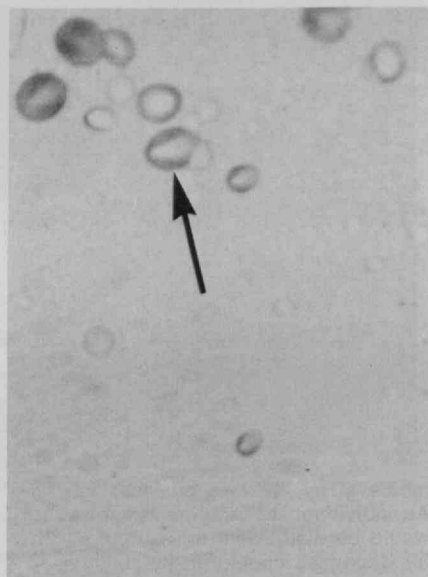
integrating element much heavier than uranium, while Dr. P. Buford Price of the University of California at Berkeley reported that his group had discovered two long tracks which could theoretically have been made by either monopoles or superheavy elements. However, scientists pointed out that identifying any tracks made by elements heavier than iron is something of a hit-or-miss business, owing to the lack of exact data, and the arguments will undoubtedly continue until confirmatory evidence appears to support the optimists or pessimists.

More definite data has come from the seismometer left on the moon by Apollo 12 astronauts Charles Conrad and Alan Bean. This has detected the impact of occasional meteoroids—about once every month, according to Columbia University's Gary Latham, a meteoroid the size of a grapefruit strikes the lunar surface within about 120 miles of the instrument. And the seismometer has also recorded a large number of moonquakes, which apparently occur at or near the time each month when the moon is closest to the earth. This activity does not, however, indicate that the moon is a seething mass of geological activity. According to Latham, the energy released in moonquakes over the whole lunar surface is probably a thousand billion times less than that produced by earthquakes, and an astronaut on the moon would probably feel nothing more than a slight tremble under his boots even if he were standing over the center of a moonquake.

#### Four Eras of Lunar History

Perhaps the most important change in lunar science between the first and second Houston conferences has been the growing agreement over a scheme of lunar evolution. While many gaps remain to be filled, scientists now generally agree on the major events that shaped the moon's surface as we now see it.

Either at its formation, some four and a half billion years ago, or soon afterwards,



scientists believe, the moon was heated sufficiently to melt its surface layers. On cooling, the top layer crystallized to become the original lunar crust. This crust was soon pockmarked by the impact of meteoroids or planetesimals, one of the most important of these being the impact that produced the vast basin in the moon's northwest quadrant that we now identify as the Sea of Rains (Mare Imbrium). In that catastrophic event, probably more than four billion years in the past, a 50-mile-diameter body crashed into the surface and scattered debris from perhaps 100 miles' depth over hundreds of miles.

Somewhat later in the moon's history, molten basalt from beneath the surface rose up and spread across the larger plains, producing the lunar seas in the form that we recognize even today. This process, whose cause remains totally unknown, obviously lasted for millions of years, because the basalts in the Sea of Tranquility and the Ocean of Storms differ in age by some 400 million years. At some point, however, the process ceased, and lunar evolution tailed off into an occasional moonquake and the impact of meteoroids which produced the moon's younger craters, such as Tycho and Copernicus.

This scheme of evolution makes it plain that the lunar surface should contain readily identified rocks from four separate eras—the formation of the original crust, the impact that produced the Sea of Rains, the solidification of the mare basalts, and the formation of the younger craters. Such rocks, if all can be gathered and dated, should provide definite geological benchmarks for lunar investigators. At present, however, only one type of rock—the mare basalts—is definitely in scientists' hands, although in KREEP and norite they may have samples of the original crust. Thus, in assigning landing points for the remaining Apollo flights, N.A.S.A. planners will bear in mind the demand for the other varieties of rock.

History as recorded by cosmic ray tracks has been the General Electric Research and Development Center's chief contribution to lunar geology. Such tracks (circle) reveal four stages in the life of a small lunar rock returned by Apollo 12 (left): It was pushed to within a few feet of the surface 70 million years ago, brought to the surface 1.7 million years ago, turned over 700,000 years ago, and splattered with molten glass 9,000 years ago. But day-to-day erosion is slow. Cosmic ray tracks (arrow) accumulated in a glass filter on Surveyor III (right) returned to the U.S. after 31 months on the moon suggest that particles from space are wearing away the moon's rocks at a rate of about one layer of atoms per year, one-half inch per 60 million years.

Thus Apollo 14 visited a site near the Fra Mauro crater, believed to contain plenty of debris from the event that produced the Sea of Rains, and Apollo 15 is targeted for Hadley Rille, which is believed to contain Sea of Rains debris, material from the original crust and young crater material. And among the possible targets for Apollos 16 and 17, if they fly, are sites in the Southern Highlands, where the surface is believed to consist predominantly of the original crust, and near the young crater Copernicus.

Of course, success in all these flights will not guarantee a complete understanding of the moon—too many of the outstanding problems appear far too complicated for solutions as simple as that. For example, the questions of why there are no lunar seas on the far side of the moon, of how the mascons—dense blobs of matter below the seas—originally formed, and of whether the moon ever had a liquid core, will probably defy explanation until the moon is thoroughly surveyed. But as John Wood commented at Houston, "I think that if we go all the way through Apollo 17, we will have a very solid body of information concerning the moon, and if things go well we ought to be able to come up with a self-consistent history of the moon that makes sense and satisfies all the data they bring back."



Peter Gwynne came to the U.S. in 1966 from the British journal *Discovery* to be Managing Editor of *Technology Review*. He has since been Science Editor of the *Boston Herald-Traveler* and is now Associate Editor of *Newsweek*.



# Points East

## Sato's Ancient Blade

### The Emerging Japanese Superstate: Challenge and Response

Herman Kahn  
Englewood Cliffs, N.J., Prentice-Hall,  
274 pp., \$7.95

Reviewed by  
Jerry E. Cook  
Sloan School of Management, M.I.T.

*"For the building of a new Japan  
Let's put our strength and mind together,  
Doing our best to promote production,  
Sending our goods to the people of the  
world,  
Endlessly and continuously,  
Like water gushing from a fountain.  
Grow, industry, grow, grow, grow!  
Harmony and sincerity!  
Matsushita Electric!"*

This is typical of the songs that Japanese management and laborers sing daily in a land where employment is for life, promotion is based on seniority, and retirement is at age 55; where unemployment is less than 1 per cent, and unions are not organized along trade lines; and where, often, firms maintain an astronomical six to one debt-to-equity ratio!

Why this system produces a 10 per cent annual growth in G.N.P., and what it may achieve in the future, are the subjects of Herman Kahn's *The Emerging Japanese Superstate*. He projects a doubling of Japan's G.N.P., to \$400 billion by 1975, Japanese per capita income passing that of the U.S. by 1990, and Japanese G.N.P. becoming the world's largest by the year 2000.

Kahn is a RAND physicist and security policy expert turned, in his own words, professional futurologist. He is the founder of the Hudson Institute and, fortunately, a man at home with controversy. His other works include *Thinking About the Unthinkable*, *On Thermonuclear War*, and *Why A.B.M.* Like these, *The Emerging Japanese Superstate* will doubtless achieve Kahn's stated goal of stimulating controversy and the contributions of others to a given subject.

The Japanese system of doing business is generally considered unworkable and

medieval by Western businessmen. An individualistic American employee would be distressed, for example, with his Japanese counterpart's ability to forecast his future salary and rank, given his age, family status, school, and firm. On the other hand, Kahn argues that those practices usually decried by Westerners as weak—lifelong employment, lack of mobility, non-competitive methods—are really the basis for Japan's phenomenal growth.

Kahn also discusses the unity of business and government—the Bank of Japan has the power to make and break firms—which has successfully blocked the entry of foreign competition and stimulated the rapid expansion of research and development to levels well above those of European nations. However, Kahn's treatment of developing technology in Japan is slight. A better discussion is found in *Business Strategies for Japan* by J. Abegglen, who reveals little-known figures—such as the fact that Japan is spending nearly 2 per cent of her G.N.P. on research and development, and has committed some 200,000 workers to this area.

One of the pleasures of delving into this book is the selection of charts, tables, and interspersed narrative of the appendix. These can be read anytime, even prior to reading the main text, for as Kahn explains, "the approach is designed to be rather like the pointillistic style of the French impressionist Georges Seurat, as elements of each module are intended to form their most meaningful pattern of relationships when combined in the mind of the reader." Who can resist charts and tables presented in such an artful manner?

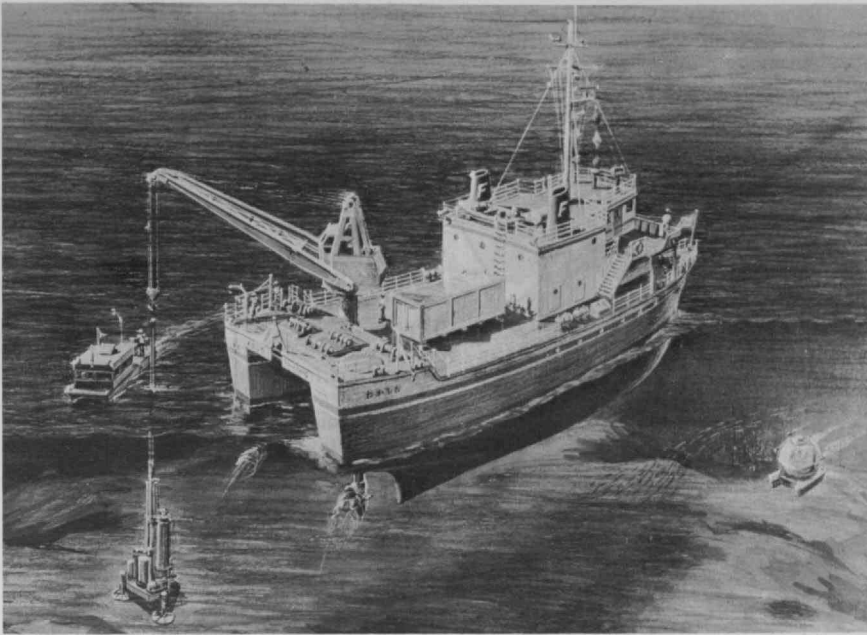
Kahn's section on the Japanese mind is most open to objective criticism. It is based heavily on the Ruth Benedict classic, *The Chrysanthemum and the Sword*, written during World War II and based on research materials then available in the United States. Although he concedes some possible dating of this reference, Kahn maintains, "I have talked to many dozens of Japanese about the book and to a man they have thought of it as perceptive and accurate . . ." (This has been my experience as well.)

Some of his other sources on Japanese character can hardly be called "data." He relates, for example, "When I was in Tokyo, the Police Department issued a statement that the taxi drivers' excessive use of car horns was bothering foreign visitors, particularly the Americans. I was later told that this resulted in a sharp decrease in that particular source of noise." Kahn's use of such "data" may be due to the absence of a single serious expert on Japan among the Hudson Institute staff. Fortunately, the reader can refer to the appendix, which contains some excerpts from the writings of noted scholars of Japanese culture on group orientation, hierarchy, emotion, self-discipline, and the like.

Kahn's portrayal of Japanese character is also questionable—to some degree. In the appendix, one finds charts titled "The Japanese Personality in Comparison with Englishmen" showing the Japanese as having "more realistic willingness to learn," "a keener desire for self-improvement," and being "more ambitious," as well as another chart, "Synoptic View of Japanese Culture," and others. The reader is cautioned to be critical of these sweeping generalizations. The substance of his treatment here, nonetheless, conveys an accurate appreciation of the differences between Japanese and Western thinking, and it is persuasive on the point that one should not confuse "a facade of Western appearance with a reality of Japanese tradition and practice."

Finally, Kahn maintains that, with the attainment of "superstate" status, Japan may emerge from her present low political and military posture. "Within the next five to ten years the Japanese are likely to unequivocally start on the process of acquiring nuclear weapons." To date, Japan has orbited a satellite and has a well-developed nuclear power industry, and she now manufactures 90 per cent of her own military hardware. Those who want to believe that Japan has renounced aggression as a political method will surely spring to contradict so heinous a thought.

Since the publication of *The Emerging Japanese Superstate*, two related, significant events have borne out Kahn's



Japan's first privately owned research vessel, the Wakashio, will be a 310-ton catamaran built by Nippon Kokan and will cost \$1,083,000. The Fuyo Ocean Development and Engineering Company, Tokyo, will use it to map undersea topography and geology, employing acoustic techniques, proton magnetometry and core-drilling. The ship will have 360° steerable propellers, and its position will be measurable to 50 cm., it is claimed.

Japan's 20 other research ships are all owned by universities or government agencies, in line with the national philosophy of cooperation rather than competition. Is Japan an emerging super-state? Reviewer Jerry E. Cook brings his experience of that nation to bear on Herman Kahn's predictions.

view. The first was the release of Japan's first White Paper of National Defense, declaring the goal of making Japan completely self-reliant in terms of defense. Perhaps even more disturbing to some will be the suicide of Yukio Mishima (one of Japan's most famous authors) who committed hara-kiri while attempting to foment a revolt among Self Defense Force troops with cries for the return to the rule of the Emperor and the repeal of the antiwar provision of the Japanese Constitution. Kahn would doubtless interpret both as steps toward putting aside the chrysanthemum and bringing back the sword.

Although lacking somewhat in scholarly documentation, *The Emerging Japanese Superstate* achieves, certainly, its aim of stimulating controversy. I, for one, would agree with Kahn's view that the United States would do better if "we were to consider judging our own mistakes in the light of another country's successes, rather than automatically assuming that cause and effect relationships common in Western industrial cultures must of necessity exist elsewhere."

### On International Illusions

**Coexistence and Commerce: Guidelines for Transactions between East and West**  
Samuel Pissar  
New York, McGraw-Hill, 1970, 573 pp., \$17.50

Reviewed by  
Padma Desai  
Research Associate,  
M.I.T. Center for International Studies  
and Harvard Russian Research Center

In *Coexistence and Commerce* Samuel Pissar covers a wide range of issues relating to trade between the communist East (including China, Cuba, North Korea, and North Vietnam) and the noncommunist West (including Japan). Besides seeking to provide a rationale for East-West trade, he describes the

growth of this trade in commodities, services, technical and industrial know-how, and copyright; traces its commercial and legal framework; and provides guidelines for its future growth. Above all, the balanced judgments and fine sensibilities of a European pervade the entire book. In discussing a subject which can become charged with emotional and political overtones, Mr. Pissar is not only moderate but also optimistic.

The main problem with *Coexistence and Commerce* is that the subject is so broad and demanding that one would have to be at once an economist, lawyer, student of politics, and man of affairs to handle with assurance and expertise the variety of issues discussed. Mr. Pissar must be judged moderately successful on most of these counts but he fails singularly as an economist, a serious detractor from an otherwise useful overview of East-West trade.

Trade between East and West has been restricted primarily for political reasons associated with the cold war. However, it has grown steadily in response to the political thaw as well as to economic compulsions on both sides—with the solitary exception of direct trade between the U.S. and the U.S.S.R. On the whole, Mr. Pissar's analysis of these developments is weak because he fails to distinguish adequately between factors accounting for past performance and future prospects, or between economic compulsions and political pragmatism.

To this day, the approach of the United States to East-West trade has remained essentially political and its style, on the whole, inflexible. Trade restrictions are applied with varying degrees of severity, so that Yugoslavia is treated practically as a Western European country, Poland and Rumania are treated more leniently than the remaining East-bloc countries, and trade exchanges with communist China, North Vietnam,

North Korea, and Cuba are totally prohibited. The relaxation of export controls, initiated under the Kennedy Administration and continued under the Johnson administration, has been mainly for selected, nonstrategic items and has invariably been in the nature of executive decrees rather than legislative enactments. On the whole, one gets the impression from Mr. Pissar's discussion that while strategic commodity controls are universally accepted in the United States, the current attitude of the administration on East-West trade is "ambivalent," that of the Congress unchanging, and that of United States business interests quite flexible.

At the other end of the Western spectrum is Japan, totally nonideological in its approach to East-West trade and quite aggressive in exploiting trade possibilities, especially with China and the Soviet Union. Geographical proximity is viewed by Japan more as a trade advantage than a cause for concern.

In between are various European countries such as England, West Germany, France, and Italy, whose powerful commercial motivation has worked at cross-purposes to their avowed interests both as members of N.A.T.O. and of the European Common Market. Thus, while U.S. embargo restrictions (especially those relating to the Soviet Union, China, Cuba, North Korea, and North Vietnam) are aimed at economic, political and diplomatic excommunication, the restrictions administered by these N.A.T.O. members apply *only* to military strategic items. Again, while the U.S. credit restrictions apply to all countries except members of the I.B.R.D. and the I.M.F., the N.A.T.O. countries have sought to expand their trade with the East on the basis of long-term credits and government guarantees.

A major aspect of Mr. Pissar's work, bearing on the future growth of East-West trade, is the commercial and legal framework under which this trade has expanded. Handicaps might have been

expected to arise from three factors: the communist legal system is devised to promote party policy and state power; most economic functions including foreign trade in the East are conducted by state agencies; and foreign firms which are authorized by governments in the East to conduct business on a long-term or permanent basis are subject to local laws. These three features imply that Western trading firms in their trade relations with the East would have to deal with the communist state agencies on the basis of laws which are not "objective and impartial."

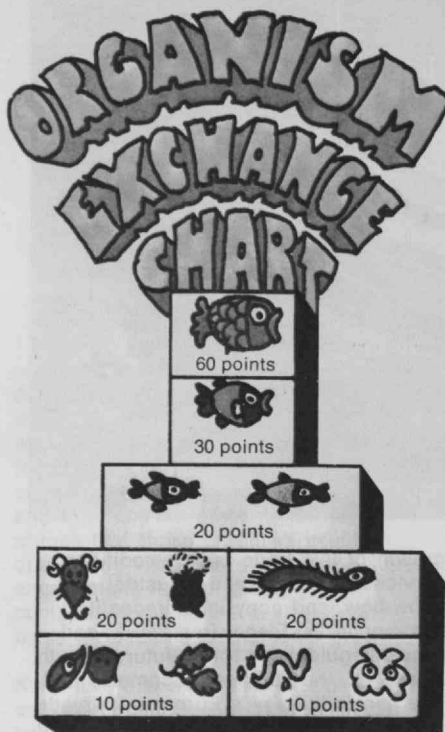
In actual practice, as Mr. Pizar emphasizes, the outcome is different. Trade disputes are settled by special foreign trade and maritime tribunals on the basis of detailed legal provisions and contractual stipulations incorporated in bilateral treaties. It seems that in actual practice, the corporate separateness, limited liability, and independent accounting of communist trading agencies are emphasized by the legal decisions of the communist foreign trade tribunals. Moreover, while communist jurisprudence does not recognize the doctrine of binding precedents, the judgments of the Eastern foreign trade and maritime tribunals have drawn on and are thus influenced by the works of well-known English, French, and German commentators.

Mr. Pizar also emphasizes that the actual record of Eastern trading agencies in carrying out their trade obligations is impeccable. Furthermore, Eastern banks, according to him, enjoy an excellent credit rating in world trading and financial circles.

However, he asserts that communist trading agencies have an inordinate bargaining power in their dealings with Western firms. Thus he states: "This power stems from the sheer size of the state monopoly and the fact that each export-import enterprise handles all of its country's trade in particular product lines and brings upon the horizon one-shot deals of great magnitude." These qualifying adjectives fail to provide one with a meaningful analysis of monopoly. For example, the Western technostucture has its own Galbraithian giants. It is difficult to believe that Western firms such as Italy's Fiat or France's Renault or Britain's Imperial Chemical Industries and Leyland Motors, to name only a few which have undertaken trade and industrial cooperation deals with the East, lack bargaining power with their Eastern negotiating agencies!

Mr. Pizar also asserts that the exchange of the most-favored-nation treatment promises by Western market economies with state-trading countries would, "at best [be] a one-sided trade concession; at worst, a palpably dangerous one." It is not clear why Eastern state-trading agencies should fail to buy from the cheapest sources as they expand trade considerably: Mr. Pizar's fears are conditioned by experience of East-West

*If you think ecology is a simple matter of checks and balances, a round of Dirty Water, involving creatures like those below, may change your mind.*



trade under essentially autarkic Eastern attitudes and also seem to be based on the naive view that capitalist trade is basically governed by impersonal market forces.

In conclusion, *Coexistence and Commerce* provides "a proposed code of fair practices" for East-West trade. While the chances of its implementation in the context of East-West trade are high, its acceptance in the context of trade relations between the United States and the Soviet Union in particular will depend on wider issues such as the outcome of the S.A.L.T. talks and the resolution of the Middle-East conflict and the Vietnam war.

## Game Review: Dirty Water

### Dirty Water

Cambridge, Mass., Urban Systems, Inc., \$10.00

Reviewed by  
Helen Ingram  
Staff Political Scientist  
Federal Water Commission

*Dirty Water* is a new environmental game for acting out your antipollution hangups. However, the average player using conventional assumptions will most likely find himself frustrated by it. The pressure is worse for the Mr. Clean who plans well and gets ahead. Even the winner—if there ever is one—leaves the game feeling that man has about as much chance to control his environment as had the brontosaurus.

Each player in *Dirty Water* is given his

own lake to stock and, if necessary, de-pollute, with a limited supply of money. Right away he learns that the optimal ecological system for his pond is not the fisherman's paradise of clear, bass-filled waters. On the contrary, a "healthy" lake needs the proper portions of sludge and muck. He gathers these by hopping about the board collecting chips representing worms, bacteria, weeds, algae, rotifers, and copepods ("copepoda: a subclass of Crustacea comprising minute aquatic forms including the order Eucopepoda of which the members are chiefly free living and important as fish food and the order Branchiura which is parasitic on the skin and gills of fish"—Webster's third edition) To win, a player must set up the perfect ecological balance, i.e. the right number of chips for each species of critter.

But beware—as you move about the board accumulating chips—of the number one danger: overpopulation. Landing on one rotifer too many will deplete a whole collection of slimy or finny things. Landing on *Pollution*, though, is the greatest risk of all.

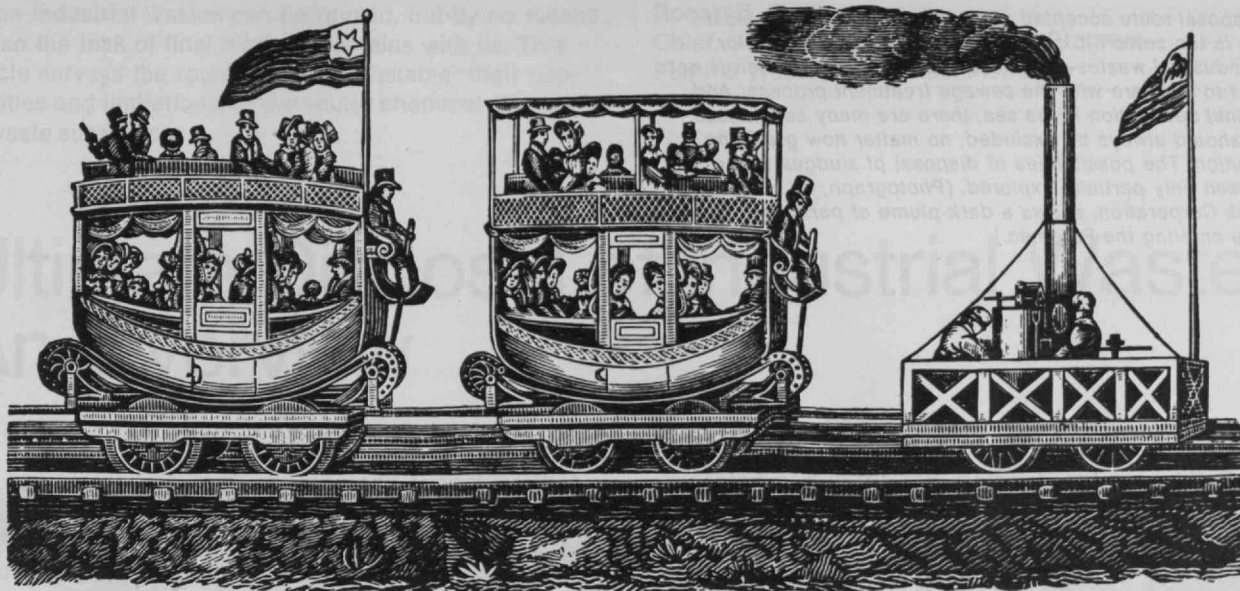
Pollution has all sorts of sources: nuclear plants, farm fertilizers, pulp mills, steel factories, household sewage, etc. Each has its very own way of wrecking the ecological balance. A good dose of household phosphates is bound to overpopulate the algae and make short work of all sunfish and bass.

The careful player is led to believe that he can protect his lake somewhat by buying pollution abatement cards. He can even bid for federal funds (up to \$200) to help the proposed cleanup. However, to be safe when the moment of need arises, he must have bought just the right antipollution device or measure beforehand and have paid fees for all the time it has been idle.

But the real psychological crunch comes when you are suddenly deluged with *uncontrolled* pollution. Despite the prior purchase of this or that device, or lavish expenditure for abatement, if the fellow upstream is hit with pollution, and has taken no preventive measures, then dirty water just naturally washes down—ruining the carefully constructed ecological balances of everyone downstream. *Dirty Water* has no way for a downstream abater to punish or correct the upstream polluter!

Frustration is inevitable. The game doesn't do much to fire the competitive spirit and develop confidence in one's wit and skill. It does, however, provide a dramatic lesson in the results of misguided practices in water management. The game will be popular so long as there is real-world avoidance of antipollution measures. And, when you have mastered these frustrations (or are fed up with them) you can either join your local citizens anti-water pollution league or go on to the next game in the series—*Smog*.





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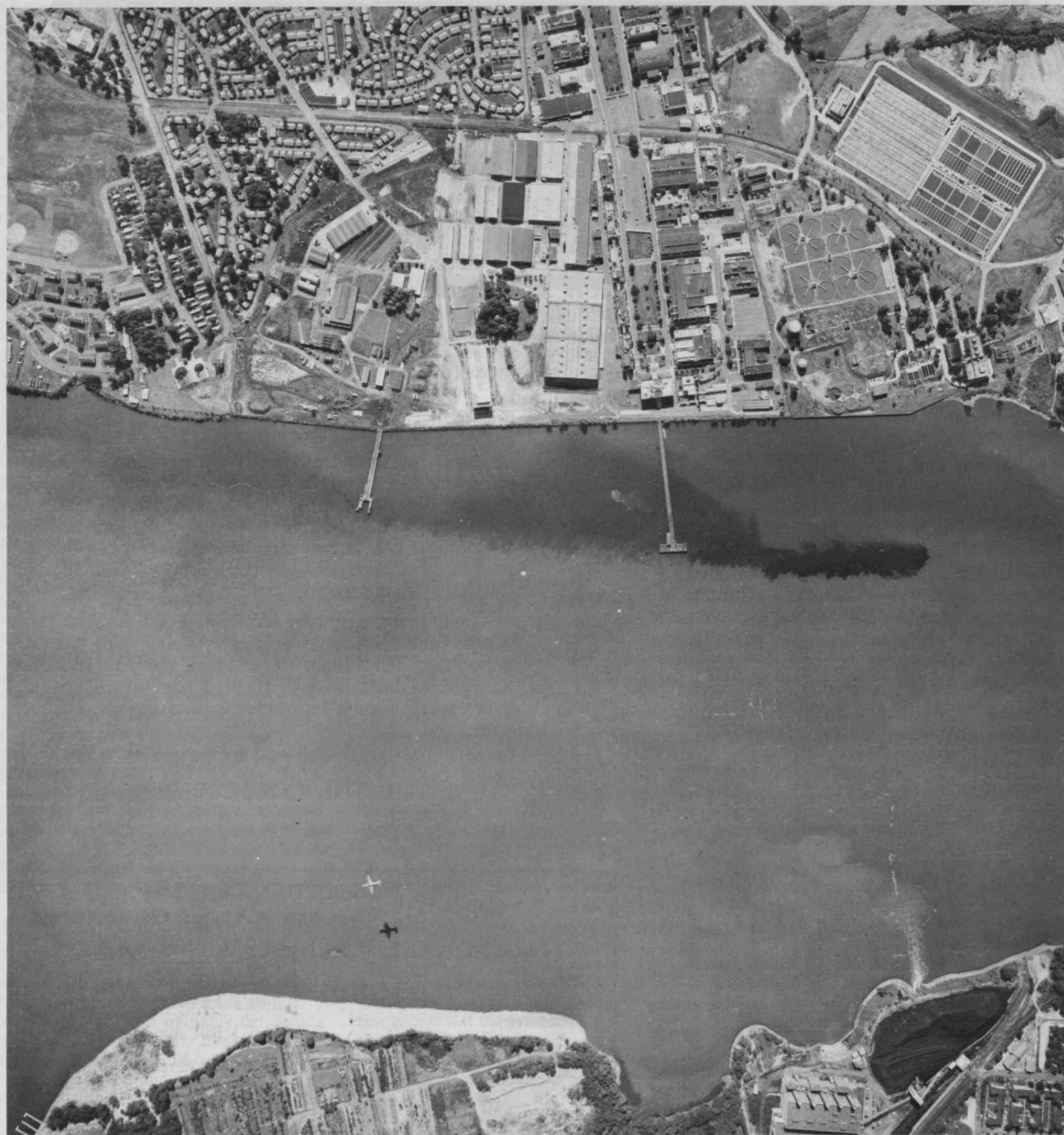
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The disposal route accepted as a matter of course by most people is the sewer. It is, in fact, an acceptable outlet for many industrial wastes—provided that their composition is not such as to interfere with the sewage treatment process. And if the final destination is the sea, there are many substances which should always be excluded, no matter how great the dilution. The possibilities of disposal of sludges to the soil have been only partially explored. (Photograph, by courtesy of The Itek Corporation, shows a dark plume of partially treated sewage entering the Potomac.)



Some industrial wastes can be reused, but by no means all, so the task of final disposal remains with us. This article surveys the routes that are available: their capabilities and limitations for particular chemical classes of waste substances

Robert B. Dean  
Chief, Ultimate Disposal Research Program  
Federal Water Quality Administration

# Ultimate Disposal of Industrial Waste: An Overview

Industrial wastes include anything and everything that has, or is believed to have, a negative economic value, that is to say, anything that is not worth the bother of further processing, and is cheaper to throw away than try to recover. You might conclude that elimination of a waste would always cost money, and in most cases this is true.

## When Is a Waste a Product?

However, there are many cases where waste recovery has paid for itself. So how did such "wastes" come to be called waste? Let us first look briefly at this kind of anomaly.

There are cases where the waste was believed to have a negative economic value but was later found to be worth saving (usually when its disposal was restricted by law). Many a firm has in the past taken the official attitude that "we are in business to make our principal product and we don't want to waste time on this or that little by-product." When waste recovery has been forced on such a firm it has frequently been found that waste recovery pays for itself.

Another all-too-common cause of economically unjustified waste lies in the complexity of most industrial operations; apparently minor sources of waste are simply not noticed by the level of management that could correct them. For example, drip from leaking glands which seems insignificant to an operator can mount up to large losses. A factory that suspects it may be losing valuable material in its effluents should procure good, rapid analytical facilities to identify its wastes, and then send a waste control engineer with a plumber to tap and sample waste streams throughout the plant. Such sampling, of course, can also detect the sources of polluting substances that require expensive treatment before discharge. Improved house-keeping usually pays for itself in waste reduction, including waste of that most precious of commodities, human life and time.

Actually, there is only an arbitrary line between economic and uneconomic wastes. A change of law or market can convert a waste into a profitable product, by pushing its economic value over the line from negative to positive, or by economically penalizing its disposal. In the early days of the chlor-alkali industry, soda was the valuable product, and chlorine was the

unwanted part in the raw material, which is salt. Today chlorine is usually the principal product, and sodium or its compounds are the excess by-products. As an example of a legal change—albeit a rather ineffective one—the first alkali act in England required a 95 per cent reduction of gaseous hydrochloric acid discharges to the atmosphere from salt cake manufacture. HCl was easily adsorbed in Gossage towers, but there was insufficient market for the resulting acid solution, and "by far the greater part was run to waste—as discreetly as possible—into nearby streams and rivers" (D.W.F. Hardie and J. D. Pratt, *A History of the Modern British Chemical Industry*, Pergamon, 1966). Thus the law succeeded in converting air pollution to water pollution. Subsequently, an increased demand for chlorine to bleach esparto grass for paper manufacture did more to alleviate HCl pollution than the law had done.

But we can nevertheless distinguish two kinds of industrial wastes: (a) those wastes which contain a usable or potentially usable substance which is uneconomical to salvage, and (b) unwanted by-products inherent in the purification of a raw material. Valuable substances of the first kind, which for various reasons may be wasted, are to be found in leakages from valves, rinsings from tanks, chemicals spilled on the floor, suspended solids in clarifier overflows, skimmings from oil separators, and many other wastes. Legal restrictions and effluent charges can easily reduce pollution from sources of this kind.

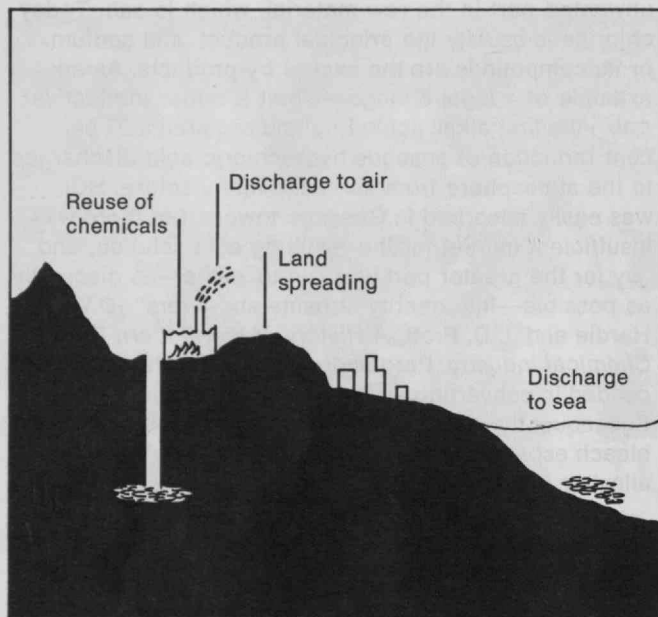
## The Truly Unwanted

Examples of the second category are the HCl by-product, already mentioned, of the salt cake industry, calcium chloride brine from the Solvay process, lignin from paper making, fly ash from wet collectors, steel pickling liquor, and acid mine drainage. The recovery of economic values from such by-product residues is much more difficult, principally because of the large volume of the wastes. The success of the meat-packing industry in utilizing all of the hog but the squeal is proverbial, but not typical. Lignin from the sulfite process can, it is true, be oxidized to vanillin. Unfortunately for the waste disposal problem, one small sulfite paper mill is able to produce vanillin enough for all the ice cream in the country.

Likewise, Vitamin B-12 can be extracted from activated sludge or other microbial sludges, but after extraction



*There are just four possible destinations for waste materials: they can be reused industrially; they can be dispersed in the atmosphere; or dispersed in the sea (where, however, they may become reconcentrated); or they can be placed on or under—or better, intermingled with—the land.*



you still have the sludge. Some fly ash is converted into building blocks, but there is more ash than the block industry can use. Pickle liquor is a cheap source of iron salts which can be used to remove phosphates from sewage, but today there are not enough sewage treatment plants removing phosphates to utilize the available supplies of pickle liquor. Mine drainage is a source of water, if the pollutants are removed, but unfortunately much of it occurs in areas where water is abundant and other sources are cheaper than purified mine drainage. (However, in areas where *all* surface waters are polluted by mines, ion exchange, reverse osmosis, and distillation are to be tried as sources of fresh water.)

Water is in fact the most massively reused "waste," in the form of industrial water streams which might have been wasted when there was plenty of water. The usual pattern of industrial water use is to "cascade" the same water through a number of processes, each one more tolerant of pollutants than the last, with perhaps some intermediate stages of purification. For example, rinse water in the electroplating industry moves countercurrent to the plated articles, getting stronger in metal ions as it goes. Useful metals in the first, most concentrated rinse may be recovered by ion exchange, and water by evaporation. However, nearly all

industrial uses of water tend to accumulate soluble salts which must eventually be discharged as a brine. The more completely a plant saves water by reuse, the worse the quality of the final effluent becomes.

There are four things that can be done with industrial wastewaters:

- ◇ They may be used again, as plating rinses are now reused;
- ◇ They can be sold, perhaps after conversion (as blood from meat packing plants is dried and marketed);
- ◇ They can be rendered innocuous (as acids are neutralized prior to discharge into municipal sewers); and
- ◇ They can be transported to a location where they will not be pollutants (as cannery effluents are sprayed on grassland).

Reuse, sale, and conversion all depend very specifically on the chemical properties of the waste, and what works for one waste will obviously not work for another.

### Disposal Where?

I have mentioned several outlets for waste disposal, including municipal sewers, the ocean, and the soil surface. There are others, some of which we can dismiss. The air is unsuitable for the disposal of substantial quantities of gases other than water vapor, carbon dioxide, and nitrogen. Outer space is much too expensive, and storage in underground caverns will be used only as a last resort because of its cost.

Uncontrolled disposal in deep wells has been promoted by some as the ideal method of ultimate disposal. Unfortunately, what goes down sometimes comes back up, with results which may be disastrous. Early attempts to dispose of citrus wastes underground created geysers of foul black liquid when anaerobic microbial action produced methane and hydrogen sulfide. Chemical wastes have produced earthquakes in Denver, and steel pickling wastes have corroded their well casings and returned to cause great embarrassment.

More subtly, and therefore more dangerously, wastes injected at one site sometimes flow through underground strata to emerge elsewhere. The flow of water underground is slow, and it may take years to detect pollution from a disposal well. Even if disposal is then stopped, it will take many times as long to flush out the pollutant as it did to detect it. Disposal into wells under pressure, which may open up new underground channels, is asking for trouble.

### The Sea

Disposal to the ocean takes advantage of the huge dilutions available and is often the best method, considering all alternatives. For example, sodium chloride, calcium chloride, and magnesium sulfate brines will be undetectable against the natural background of these salts in the ocean—even hydrochloric acid can safely be diluted in the ocean—whereas, since these substances are water soluble and cannot practicably be converted into solid precipitates, their disposal on the land or into fresh waters is highly objectionable. Water will eventually reach the ocean no matter how you

dispose of it. Certain nutrients, both organic and inorganic, may be beneficial in increasing the harvestable crop from the ocean, and in colder waters thermal wastes may also be useful.

But there are many substances which should never be discharged to the ocean, no matter how great the dilution, because they are toxic and are concentrated as they pass up the food chains from plant to animal to predator. Marine biologists have known for years that some elements are highly concentrated in certain marine organisms—elements of which the biological function is not obvious. Vanadium, for example, is concentrated by a factor of nearly 300,000 in some tunicates. Cadmium is concentrated by a factor of over 2 million in scallops. More recently, we have been made aware of the concentrations which mercury and refractory oil-soluble substances may reach in this way. A nontoxic example of biological concentration is provided by the familiar cod liver oil, which is so good for you because it contains oil-soluble vitamins. Do not blame the cod for synthesizing these vitamins—they were produced by green algae which were eaten by small organisms that were eaten in turn by larger ones and so on up to the cod. It may take ten pounds of food to produce one pound of cod, and a similar concentration factor holds right down the food pyramid. Along with the vitamins, any oil-soluble substance that is not actively excreted may be concentrated. That is what happens to D.D.E., derived from D.D.T.; many fish-eating birds are approaching extinction because of pesticides that, to start with, were diluted in "the whole ocean."

As we now know, mercury is converted to an oil-soluble vapor, dimethyl mercury, by anaerobic bacteria, and is concentrated in fish and shellfish. Analytical surveys for heavy metals have generally missed mercury, in the past, because of the volatile nature of its compounds. Pretreatment of industrial wastes by boiling in acids or ashing to destroy organic matter may let most of the mercury escape.

Between the obvious perils of mercury and the obvious safety of sodium chloride, there is a vast range of substances whose candidacy for disposal in the ocean is not so clear-cut. General organic wastes that settle to the bottom, including garbage, will be decomposed by marine bacteria. Iron salts will form ferric hydroxide minerals, which are already present in ocean sediments along with many other minerals. The key to safe disposal of such substances is control of quantity. There can be too much of a good thing. Excessive deposits of iron minerals will suffocate bottom-dwelling organisms; excessive quantities of organic wastes will cause anaerobic conditions and hence a complete transformation in ocean-bottom life. Aside from killing higher organisms, the loss of oxygen can cause other problems. There are many elements, such as copper, which are necessary for life at low concentrations but are toxic at higher levels. Copper is fairly insoluble in sea water with a normal oxygen level, but the anaerobic decomposition of garbage releases amino acids whereby the metal may be chelated and thus reach higher than healthy concentrations.

*The soil can take in and transform many kinds of waste products, provided that it is not overloaded. Photograph shows the spraying of sludge on fields at Viersen, near the Netherlands border in Germany.*



Substances which float to the surface, such as oils, greases, rubber, and polyolefins, are concentrated in ratios that dwarf the hoped-for ocean dilutions. Consider a million gallons of sewage, diluted a million-fold in a cubic mile of water. Oils will concentrate at the surface in a layer less than 1/100 of a mil thick, completely cancelling the original dilution factor and replacing it by a concentration factor of 6,000 for this component. Winds can blow this surface up on the shore, concentrating it by another factor of 10,000 at the beach line. There can be no justification for the discharge to the ocean of flutable materials which do not quickly degrade.

### **The Sewer**

Municipal sewers, when available, provide by far the most convenient and least expensive method of disposal, the method accepted as a matter of course by most people. What is disposed of in this way will undergo treatment in the local municipal system, which can be advantageous if the rest of the sewage provides useful dilution of toxic substances or necessary nutrients for bacterial growth.

For example, paper mill wastes and many soluble organic wastes are deficient in nitrogen, phosphates, or both. Municipal sewage, in contrast, normally contains more nitrogen and phosphorus than is needed for cell

*At Houston, Texas, Shell uses soil disposal for oil wastes; the upper two photographs show oil being discharged and then mixed into the earth. In Stark County, Ohio, birdsfoot trefoil and orchard grass grow on stripmine spoil which has been enriched with two inches of sludge; the bare soil to the left was not treated.*

growth. To treat the paper mill wastes by themselves would require the purchase of nutrients for bacterial growth, and some of these nutrients would inevitably appear in the effluent. Combined treatment of industrial and municipal wastes can be in the best interests of all parties—if the industry pays its share of the larger treatment plant required and takes the necessary precautions to exclude toxic wastes which would interfere with the biological treatment. Soluble organic substances that can be efficiently removed in a well-run “secondary” treatment plant (as this kind of process is termed) include organic acids, alcohols, and esters (but not glycol ethers), as well as many water-soluble aromatic compounds, including phenol, and even limited quantities of hydrocarbons. It may be necessary to develop organisms specifically to degrade the more exotic substances, and precautions must be taken to avoid sudden changes in the waste composition.

To avoid killing the microorganisms it is necessary to exclude heavy metals, chromates, chlorinated solvents, and cyanides, as well as strong acids and bases. Antibiotics and many pesticides can also upset biological treatment. Laboratory and pilot plant operations require special attention, because chemists think nothing of rinsing substantial quantities of anything down the drain including spent dichromate cleaning acid, deliquesced zinc chloride, and dirty methyl chloroform. One carboy of any one of these materials is capable of upsetting a municipal treatment plant.

### The Soil

A natural biological treatment is, and has always been, provided by the soil (and here I am not speaking of landfill). Filtration through fine soil removes all particulate matter. Most cations (except sodium) and some anions (including phosphates) are strongly adsorbed by soil minerals. Organic matter is decomposed by soil bacteria at rates that make land disposal much cheaper than incineration.

Chicago has calculated that, for wet sludge, land disposal will cost about one-third as much as incineration or wet oxidation. The Shell Oil refinery in Houston routinely decomposes one acre-foot of oily wastes on each of seven acres of land each year. One bulldozer, keeping the oil and soil mixed and aerated, annually disposes of 50,000 barrels of waste. Of course, the Houston climate favors biological action, and slower rates would





## New Directions for Urban Research

be expected in areas where there is frost. Nevertheless, the rate of decomposition of organic matter is seldom the factor limiting the rate at which aqueous wastes can be applied to the land.

But again, there are wastes which must be avoided. Soluble salts can pollute ground water: chlorides and sulfates are not retained in the soil; nitrates, which may be formed by bacteria from ammonia and organic nitrogen compounds, likewise move freely in the soil. Some nitrates are taken up as nutrients by growing vegetation, but any excess goes into the ground water and can pollute drinking-water supplies. (However, if this kind of ground water pollution seems likely to happen, it is often possible to avoid it by collecting the water as it leaches from the soil, and giving it further treatment. For example, recent studies at Firebaugh in California have shown the practicability of treating drain-tile water from rice fields to remove nitrates.)

But the land can tolerate large quantities of insoluble salts of calcium, iron, aluminum, silica, and other oil minerals. The General Electric Co. near Cincinnati has applied successive loads of calcium carbonate and fly ash to grain fields, until at present the crop grows in a surface that is about two feet above the original soil level. More fertilizer than normal is needed, but the soil has not been destroyed.

What kinds of wastes lend themselves particularly to land disposal? Naturally enough, agricultural and forest wastes are near ideal. Sludges from biological treatment are generally less suitable, being low in solids and expensive to dewater. The key to success (as with ocean disposal) is control of quantities. Too much water can result in a kind of swamp, with little oxygen getting through to the underlying soil, which becomes unable to support the desired biological action; anaerobic forms of decay take over, detectable by their unpleasant odors. Anaerobic degradation is much slower than aerobic. Indeed, unless oxygen is present, many organic substances, such as petroleum products, are not decomposed at all. Toxic heavy metals (currently the most notorious are lead and mercury) should also be kept off the land.

The maximum loading of sludge that can be accepted by the land depends critically on the way the land is being used. If the destruction of waste organic matter is the

main purpose, the soil can perform this limited function at much greater loading rates than can be tolerated if cash crops are being grown, as in the Cincinnati example. Land which has been rendered almost lifeless, such as a mining dump, requires much more sludge for rehabilitation during the first year or two than it will accept after it has been converted to forest or farm. During severe winter weather, waste application may be impractical and is usually undesirable (as the soil processes slow down) so storage lagoons are necessary.

There are other practicable waste disposal methods. Sludge and wastewaters have been successfully disposed of by irrigation of raw crops, by flooding from tank trucks, and by spraying over permanent pasture and forest land. Forest litter holds sludge even on steep slopes, and prevents run-off. Decomposition of organics will probably not be as rapid here as on plowed land, but the cost per ton of sludge may nevertheless be lower when the purchase or leasing of the land is taken into account.

Assimilative disposal of wastes on the land, which does no permanent damage, is clearly a very different thing from uncontrolled dumping, which destroys the soil and may lead to serious pollution of ground water. Far too few engineers have a feel for proper rates of application to the soil. They forget that a little too much can change dilution to pollution. If you want to use a farm or a forest as a disposal site, there is no substitute for a good farmer or forester to manage it.

*Robert B. Dean has been chief of the Ultimate Disposal Research Program of the Federal Water Quality Administration's Advanced Waste Treatment Research Laboratory, in Cincinnati, since 1967, having held a similar post from 1964. A chemistry graduate of the University of California, Berkeley, he obtained a Ph.D. in experimental zoology at Cambridge University, England, and then spent 13 years teaching chemistry and physiology at a number of universities. During this period he wrote Modern Colloids (Van Nostrand, 1948). From 1952 until his entry into government service, Dr. Dean was manager of the Borden Chemical Company's Sales Development Laboratory. This article is based on a paper presented at the 1970 conference of the Water Pollution Control Federation.*

*"In our highly urbanized society I believe urban research for all practical purposes encompasses all socially oriented research relevant to the majority of our population. The only research areas I rule out are those exclusively devoted to rural or non-metropolitan problems—for example, those concerning farming or forest conservation." (Photo: Owen D. Franken)*



Our most urgent urban problems are not technological but social; and social issues stand between our ability and our willingness to support significant research on them. Can we rise above the dilemma of our own limited vision?

Anthony Downs  
President  
Real Estate Research Corporation

# New Directions for Urban Research

Defining an urban research agenda requires a great deal of subjective judgment. The first step is to confront exactly what is meant by the word *urban*. The second is to choose one or more of the three basic approaches to formulating any research agenda.

In our highly urbanized society I believe urban research for all practical purposes encompasses *all* socially oriented research relevant to the majority of our population. Therefore, I will make no attempt to limit the scope of what I consider urban research to subjects that are explicitly identified with cities, suburbs, or metropolitan areas. The only research areas I will rule out are those exclusively devoted to rural or nonmetropolitan problems—for example, those concerning farming or forest conservation.

## Three Kinds of Urban Studies

The research approach most often used in universities is to have no formal rules for selecting subjects but simply to let a group of capable people study whatever they find interesting. This “pure research” approach dominates urban research in the United States today simply because so much of it is done in universities. In essence, this approach shifts the problem from defining the most important subjects to selecting the group of people whose interests are to be relied upon. However, since I am not a university expert capable of picking the best researchers, I must eschew this method.

A second possible approach is oriented to research goals. It typifies the form of decision making usually called “planning,” in which one starts by defining objectives and then figures out how to achieve those objectives most efficiently. Unfortunately, in our society it is not easy to define social objectives in a widely acceptable way. This is true whether we look at short-run social issues, where conflicts of interest make definition of nearly unanimous objectives almost impossible, or long-run issues, where defining objectives would amount to specifying some ultimately desirable social order. I can hardly seek to resolve the major conflicts of interest relevant to urban problems in this short paper. Moreover, I do not believe any perfect society can ever be created on this earth; so I cannot define the traits of such a society and use them as goals. Therefore, I am also incapable of using this approach to selecting the most important topics for research.

The third approach to defining a research agenda emerges from attempting to cope with what seem to be our most pressing problems at the moment. This fits the form of decision making described by Charles E. Lindblom as “disjointed incrementalism.” It is “disjointed” because thousands of individuals make decisions without much attempt in advance to take account of what others are doing. It is “incremental” because they make those decisions in response to their immediate problems, rather than in striving to attain long-range goals. I will follow this approach in developing a suggested agenda for urban research because it is the only one I am capable of using.

## What Are the Highest-Priority Urban Problems?

The most common method of delineating high-priority urban problems is to go down a list of basic subject areas related to urban affairs and identify the most critical issues in each area in the opinion of whoever is making the selection. These subject areas include health, pollution, housing, crime, transportation, poverty, hunger, unemployment, job training, education, and aesthetics. However, I will take a somewhat different approach by defining three basic issues which cut across all these specific subject categories. I believe these three issues encompass our most serious problems but do not receive sufficient attention precisely because we usually approach urban research in the manner I have just described.

The first major issue concerns the well-known gap between the rate of speed at which technological change occurs in our society and the rates at which social, legal, political, and administrative institutions change. I will refer to this as the *need for institutional change*.

The second major issue concerns the nature and development of *individual and social values*. How are these values formed and stimulated? How diverse are they becoming? How much value-diversity can our society stand without generating excessive conflict?

The third basic issue concerns *the persistence of serious inequalities* in our society (and in all other societies, for that matter). I refer to economic, social, political, and even physical inequalities. What are the origins of these inequalities? To what extent are they desirable and to what extent undesirable? How can we ameliorate those which are undesirable?



In the remainder of this paper, I will discuss each of these three key issues in turn, and suggest some directions for urban research derived from each.

### Research and the Need for Institutional Change

We all sense that moving towards solutions for the major social and economic problems of our nation will require significant institutional changes in a variety of different fields. Marginally changing the behavior of existing institutions can indeed create some important improvements regarding key problems. But really launching an effective attack upon most of them will require a fundamental restructuring of many existing institutions. The administration's Family Assistance Program provides an example of such restructuring in the field of welfare activities.

In my opinion, at least three major areas of research are suggested by this need for significant institutional change in society. The first consists of providing much better evaluations of the performance of many existing institutions, or possible future ones. Our capabilities for analyzing the potential effectiveness of public actions are incredibly poor. This is not because officials are stupid or analysts incompetent; it is because of the extraordinary difficulties of performing worthwhile and accurate evaluations of social programs, and because of the inherent reluctance of public officials—like all other human beings—to expose their own shortcomings to public view. In order to tackle these deficiencies, we need to devote far more research attention to three subjects:

◇ *Methods of coping with the multiple values and objectives involved in most public programs.* Evaluation involves measuring the actual performance of some activity in attaining a specified set of goals. But there are a great many different and often conflicting goals involved in every major public program. Hence it is extremely difficult to decide against which ones performance should be measured, or how to measure it against all of them simultaneously.

◇ *Methods of measuring, or at least estimating, the intangible benefits of many programs.* Almost all cost/benefit analyses of public programs break down because a significant proportion of key benefits cannot be measured with the usual empirical tools and concepts. Until we develop some new methods of taking these benefits into account and weighing them quantitatively, we will be unable to evaluate the effectiveness of most important social programs.

◇ *Creation of a standardized means of incorporating income distribution questions into evaluation analysis.* In most real situations, it is patently false to assume that redistribution questions can be ignored because the costs are borne and benefits received by the same set of people. On the contrary, the way most public programs take resources from some people and provide benefits for others is a critical factor that must be taken into account in assessing the value of those programs. Hence it is almost never sufficient simply to add up the total costs and benefits of a program (assuming they can all be quantified) to determine which is larger on a

net basis. In addition, its redistributive aspects—that is, who gains and who loses—must be taken into account in a way that can be transferred from one case to another and will be widely accepted as just and accurate by key decision makers.

I believe these objectives can best be attained only by actually trying to evaluate many particular social programs. This will certainly not be easy. In fact, the tremendous difficulties involved are one of the key reasons we have failed to perform evaluations effectively in the past. Yet our approach to evaluating each particular program must be carried out with full recognition of the many purposes it serves, the intangible costs and benefits it involves, and the welfare distribution questions it raises. For example, I have recently been doing some work on analyzing the effectiveness of various devices for carrying out racial desegregation in the public schools. This analysis clearly shows that school desegregation is not entirely, or even primarily, an educational process. Rather, in most communities where it occurs, school desegregation represents a fundamental social change or is a symbol of such change. Hence it creates repercussions throughout the local community above and beyond those which occur within the schools. Viewing school desegregation either solely as an educational event without regard to its social consequences, or solely as a social event without regard to its educational consequences, can lead to tremendous errors in understanding and evaluating this process.

A second basic area of research suggested by the need for fundamental institutional change in society is an exploration of how basic social changes really take place. Is it true that human values must be altered before major behavior patterns can be changed? Or can actions which first change behavior patterns then generate repercussions that alter values? Or are both of these relationships valid under various circumstances? If so, under what conditions would it be most effective to change behavior first, and under what conditions should values be altered first?

In my opinion, it is not always necessary to change human values before altering behavior patterns related to those values. For example, many white Southerners vowed they would never provide equal treatment in public accommodations for black citizens because their values forbade it. But the Civil Rights Act of 1964 called for provision of such treatment and forced most white Southerners to provide it. As a result, Southern white behavior regarding public accommodations has altered dramatically in many cases, and Southern white attitudes and values have swung markedly towards greater acceptance of racial equality. I believe this change in values, which George Gallup has called the most dramatic in the history of his polls, results directly from the prior alteration of long-entrenched behavior patterns through the force of law. On the other hand, it is certainly true that not all values can be changed by legally altered behavior patterns.

Certain causal aspects of institutional change also deserve further research. For instance, how are major institutional changes started? Who starts them? What

"It is easy to criticize many of our existing institutions, but we tend to take their structure so much for granted that it is hard to visualize and formulate practical alternatives that might work anywhere near as well. In fact, my own greatest antipathy to most social criticism today is that it fails to advance feasible alternatives to what it condemns. Instead, it takes the basically nihilistic and anarchistic approach of attacking existing institutions for their obvious faults, often advocating their immediate destruction, without even vaguely specifying what might replace them." (Photo: Owen D. Franken)



are the processes by which support and opinions are mobilized behind, or in resistance to such changes? Are there certain well-defined sets of factors involved in these processes, or is there no recurrent pattern? Many of these questions have been studied for a long time, particularly in regard to other cultures, and a great deal of theory exists concerning them. But how well does that theory hold up under the conditions of modern mass society—particularly where mass media have such tremendous (though unknown) effects?

Another related question concerns the difficulty of mustering majority support for public programs which essentially benefit minority-sized groups. Most urban problems involve deprivation or the bearing of serious costs by *relatively* small groups in society, while the majority is reasonably well off concerning that problem. For example, in 1967, 13.4 per cent of the population of the United States lived in poverty by the official definition. That percentage encompassed over 26 million people—a huge number. Yet over 86 per cent of the population did *not* live in poverty. Moreover, nearly one-half of all poor persons cannot earn their way out of poverty; they cannot work because they are either too old, too young, disabled, or mothers of young children. These people can escape poverty only if the majority which is not poor provides resources for them. Thus, any social program aimed at significantly reducing poverty must involve persuading the nonpoor majority to aid the relatively small minority.

Most of our severely pressing urban problems are quite similar in structure. These include the prevalence of hunger, inadequate medical care, direct suffering from crime and drug addiction, poor housing, mental illness, unemployment, and racism. How can majority support—which is necessary for large-scale public action in our majority-oriented political structure—be created for minority-serving programs aimed at attacking these problems? How is the creation of such support related to the ability of relatively wealthy minority groups (such as newspaper publishers or giant oil production firms) to garner support for public policies (like newspaper anti-trust exemptions and oil import quotas) which clearly aid even smaller minorities?

A further field relevant to institutional change which needs a combination of greater research and more profound analysis is the definition of alternative future institutional forms that represent possible improvements on existing ones. Real Estate Research Corporation has recently been working on one such problem in the field of transportation planning. We attempted to design alternative institutional arrangements to improve the present means of planning and building major transportation arteries in urban areas. This task turns out to be staggeringly complex. For example, after formulating a number of possible institutional formats at the state, metropolitan-area, and local levels, I calculated that over 800 million possible combinations of institutional structures could conceivably be used for transportation planning. Our fee for this assignment was reasonable, but it was hardly large enough to evaluate 800 million possibilities in depth! So I rather arbitrarily narrowed the choice down to under 100.

This example illustrates the inescapable need for subjective judgment—indeed, wisdom—in performing such institutional simulations, for that is what they really are. Yet I believe there is a tremendous shortage of new ideas about feasible institutional forms. It is easy to criticize many of our existing institutions, but we tend to take their structure so much for granted that it is hard to visualize and formulate practical alternatives that might work anywhere near as well. In fact, my own greatest antipathy to most social criticism today is that it fails to advance feasible alternatives to what it condemns. Instead, it takes the basically nihilistic and anarchistic approach of attacking existing institutions for their obvious faults, often advocating their immediate destruction, without even vaguely specifying what might replace them.

To say that this approach is consistent with the essential irrationality of the latest style of discourse, which emphasizes direct action and emotion rather than reason, may seem a plausible defense to some people. But to me it appears to be a capitulation to stupidity, ignorance, and likely disaster. The purveyors of such purely negative criticism clearly do not think in the way that good economists should. The basic economic concept of “opportunity cost” should train economists—and social scientists generally—to compare any particular policy or arrangement only with alternatives that are realistically possible, rather than with unreal perfection that can exist only in pure theory. This form of thinking also has the great advantage of imposing a critical self-discipline upon the mind, because it rules out “fairy-tale” solutions to real problems. In my judgment, we need a great deal more of this combination of imagination—to visualize significantly different alternatives—and intellectual discipline—to confine oneself to those which are really possible.

### **Research Concerning Individual and Social Values**

The second major issue which I believe should be a key focal point for urban research concerns the nature, formation, and operation of individual and social values in our modern world. This is an extremely difficult subject to study. Moreover, it is by definition “value-laden,” so no one can be wholly objective and scientific about it. For that reason, most social scientists have shied away from dealing with values. Yet I believe no subject is more critical to the survival of freedom and growth in our society.

The first topic that I would suggest for research under this basic heading concerns the impact of modern communications media—especially television—upon our values. Television is the most effective communications medium in the history of the world in terms of its degree of penetration of a large society. Over 95 per cent of all the households in the United States—including those at the lowest income levels—contain television sets. Those sets are on between 25 and 35 per cent of the time that anyone in those households is awake. In fact, some experts have estimated that the average child growing up today spends more time by the age of 18 watching television than attending school. Clearly, considering the millions of dollars that advertisers are willing to spend to influence people



through this pervasive medium, its commercials must have significant effects upon us; so I presume the rest of its contents also affect us.

But what are these effects? Is it true that television programs and commercials, and the commercials from other media, stimulate the poor to want more than they can afford and to be less patient with poverty than ever before in history? Is it true that the tendency of television news and other programs to focus on the extreme, the marginal, and the unusual because of their entertainment value creates an exaggerated picture of extremism that frightens the middle class in our society? Is it, therefore, true that television helps polarize the conservative middle class and those in society seeking institutional change? How do all these things affect our national life? Frankly, I do not know with any certainty. But I am convinced that the answers are extremely important to all of us.

Some of the issues involved in television's effect upon values can be illustrated by a story which Marshall McLuhan tells about television newscasters. He sets forth three contrasting views on how newscasters are related to the content of the news they report. These views are stated in the form of an analogy to three baseball umpires describing how they make decisions in a ball game. The first umpire says, "I call them the way they are." In McLuhan's opinion, this is the view which Vice President Spiro Agnew believes television newscasters ought to have: they ought to accurately reflect reality without bias. The second umpire says, "I call them as I see them." According to McLuhan, this represents the view which the Vice President opposes in television newscasters, whom he accuses of imparting their own biases to the reporting of news. The third umpire says, "Until I call them, they ain't!" This reflects McLuhan's own view that television news broadcasts cannot possibly mirror reality in any meaningful way. After all, there are 3.5 billion people in the world, and each undertakes at least ten acts every day. Yet the average television newscast reports somewhere between 15 and 35 different events (excluding weather and sports). It is totally impossible for any selection of such a tiny fraction of all events to accurately represent reality, even if each event involves the activities of several thousand people on the average. Therefore, argues McLuhan, newscasters do not and cannot select items in order to reflect reality faithfully. On the contrary, since they want to attract high audience ratings, they select those items which they believe the audience itself wants to see. So the audience, in effect, "manages the news" in a circular chain of causation which is only partly influenced by the values of newscasters themselves.

The main point is that the concept of "pure" reporting of reality simply makes no sense under these circumstances. This creates a tremendous dilemma about how media *ought* to behave, considering their impact upon our perceptions of reality and upon our values. In my opinion, my own admittedly immense inadequacy in grappling with this subject illustrates the infantile nature of our general thinking about this crucially important area. It cries out for further research and for

profound analysis based upon more than the hunches of socially responsible observers.

A second vital research topic related to values concerns the role of expectations and feelings of satisfaction and dissatisfaction in influencing social and individual behavior. It sometimes seems that we live in a society where millions demand instant gratification of every sensual and other desire. As novelist Saul Bellow puts it in his book *Mister Sammler's Planet*, "What it amounted to was limitless demand—insatiability, refusal of the doomed creature (death being sure and final) to go away from this earth unsatisfied. A full bill of demand and complaint was therefore presented by each individual. Nonnegotiable. Recognizing no scarcity of supply in any human department. Enlightenment? Marvelous! But out of hand, wasn't it?"

These demands are usually made without any regard for the cost of producing the social outputs necessary to satisfy them. Yet I believe a good case can be made for the conclusion that our higher levels of social tension do not result from lower production or poorer performance by the social system as a whole. On the contrary, in many respects, it is more successful at producing valued outputs and ameliorating serious problems than it has ever been. What is at fault is the immense escalation of our expectations and demands. But we need research to determine whether this conclusion is true. And if it is, what causes aspirations to out-run performance? How can socially responsible leaders reduce the gap between aspirations and performance?

A related question concerns the impact of widespread impressions of victimization which have been created in many groups in our society. I worked on the Kerner Commission Report, which I believe accurately described the way whites have victimized blacks through racism in the last 400 years in America. But did the Commission's enunciating this truth so clearly cause blacks to feel even more intensely like victims? Did this contribute to a "victimization syndrome" that weakened their efforts at self-improvement and instead channeled their energies into righteous indignation and socially destructive protests?

A striking example of current efforts to create feelings of victimization in people who do not now think of themselves in this way is the so-called women's liberation movement. The avowed purpose of many relatively moderate leaders of this movement is to greatly escalate discontent among American women, most of whom do not now feel much need to be liberated. Their present feelings of relative satisfaction in society (polls show that most American women feel they have easier lives than most men) constitute a horrible error, according to women's liberation leaders. This error must be rectified by producing far more intensive unhappiness with their present state among millions more women in order to create social and institutional change. Here is an explicit strategy of deliberately multiplying discontent, escalating aspirations to probably unrealistic levels, and thereby increasing tensions and anxieties in at least half of the population! Will it work? If so, how and why? And how is this deliberate creation of dis-



satisfaction related to the unconscious stimulation of unrealistic aspirations by advertising, criticisms of society by comparing it with perfection, and media exposures of social injustices and corruption at all social levels?

Related questions concern the impact on values of our entire educational system, with its heavy stress upon empirical inquiry rather than the acceptance of authority. Is such stress undermining the acceptance of even the minimally necessary degree of authority in society? To what extent is the Vice President correct about the effects of permissiveness? That is, does such permissiveness weaken the minimally necessary adherence to a core of social values shared by everyone (and thus liable to be considered "conformist" by some)? Heretical as it may seem to academicians for me to agree with the Vice President, I do not believe these are foolish or irresponsible questions. On the contrary, attempting to answer them in a rational way, making maximum use of empirical findings, seems to me an extremely important step towards discovering how to preserve the cohesiveness of values at the heart of any society. Such cohesiveness is necessary to keep the society from either falling apart or reacting violently to impending anarchy by accepting repression and dictatorship.

The third value-oriented research topic I believe should be investigated involves the diversity of values in our society. How diverse are the major values held by our population? In particular, how varied are our standards of public behavior? Who is teaching what values to whom, and by what means? What values are children learning from their parents, their peers, television, schools, churches, or other influences? I believe any society can tolerate only a certain degree of diversity about core values and still retain an important element of individual freedom. Are we teetering on the brink of this tolerance plateau? Or can we sustain far more diversity without serious difficulty? I don't know. But I believe we should seek to find out much more about this subject than we know now—and as soon as possible.

### **Research Concerning Social Inequality**

My third suggestion of a basic topic for urban research is the great degree of inequality in our society, as measured by almost every known indicator of either condition, trait, benefit-receipt, or output. This topic already occupies a central place on the agenda of many social scientists and urban specialists, and a great deal of excellent work has therefore already been done on it. By nominating it for further research, I am not contending that all—or even most—existing inequalities are undesirable. Some are quite desirable; some are highly undesirable; some may be unimportant. In fact, identifying which are which is in itself an important topic for analysis.

The first aspect of this subject which I believe needs much more research concerns who is really receiving the benefits of various public programs, and who is paying the costs. This is extraordinarily difficult to determine in many cases; but it is very worth investigating,

in part because some of the answers are so surprising. For example, the proponents of spending more money on highway construction extoll what they call the "user-benefit principle" as a means of tying motor-fuel-tax money into the building of roads. Since motorists pay these taxes, such proponents argue, the money ought to be solely devoted to building roads on which those motorists can drive. Otherwise society would "violate" the user-benefit principle *modally* by using the money for something else. But closer analysis reveals that the road builders themselves "violate" this principle *geographically*. They use money collected from big-city motorists to build a disproportionate mileage of roads serving rural areas; but they do not discuss this "violation" of the user-benefit principle, or even recognize it. In my opinion, the same basic principle could be invoked to demand that all the money generated by motorists in a given metropolitan area be retained in that geographic area—but spent on either roads or mass transit as the area's needs dictate. This combination of "geographic purity" and "modal violation" of the user-benefit principle would be just as consistent—and inconsistent—as the present combination of "modal purity" plus "geographic violation." In addition, it would provide far more benefits to the lower-income groups who must use public transportation.

Another question of who receives benefits and who pays involves the recently popular concept of the "forgotten middle-class Americans." Is there such a "forgotten" group? Or is it a mythical creation of constant repetition of an idea by public officials, politicians, and major media? I am a board member of a major hospital, and I believe there indeed is a "forgotten middle class" concerning medical care. Patients on welfare, and those who are wealthy enough to buy insurance, receive better medical care at less cost themselves than those just above the welfare line. But in housing, the major subsidy of deducting mortgage interest and property taxes from federally taxable income goes to the middle class and the wealthy—not the poor. What is the true overall picture regarding the sizable group of Americans in the middle of the income distribution?

If we wish to overcome such inequalities as we detect through better research and analysis, what basic delivery strategies can be devised to accomplish this? What new institutional structures do we need to carry out these delivery strategies—concerning food, housing, medical care, and schools, for example? How can political support be aligned to achieve these changes? Clearly, these topics need more research and thought.

In the back of my mind lurks a feeling, as yet empirically unproven, that our society may not be able to effectively attack many key inequalities without physically, geographically, and socially mixing different economic and social classes in schools, in neighborhoods, at work, and perhaps even genetically. Is this feeling accurate? Or is Professor Edward Banfield correct in asserting that there is a "lower class" group in society that cannot be elevated but can only resolve its problems by dying out? What implications do these two conflicting ideas of mixing or isolating classes have for geographic dispersal of the poor in suburban growth

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"... The kinds of research we most desperately need to help solve our most severe urban problems are precisely the kinds we are least willing to finance. . . . The same thing can be said of the kinds of policies and programs we most need to solve those problems. I do not know of any easy way to solve this dilemma." (Photo: Owen D. Franken)



areas? And if it seems desirable to bring low-income households into middle-income suburban and other neighborhoods, how can political support for this be developed in a middle-class-dominated electorate?

One issue concerning inequality of particular interest to the academic community involves the future role of universities in society. I believe we now suffer badly from the lack of any alternative to a college education as a socially prestigious or acceptable path to maturity for young people. For many young people are not intellectually, emotionally, or vocationally suited to college and university training as it has been traditionally carried out. Can we devise some other path to maturity which will give these people self-respect, social esteem, and decent incomes without a college degree? Or must we follow another path to greater equality—already being tried in some institutions—by opening up the gates of college to everyone? If we indeed universalize our colleges and universities to give the trappings of educational equality to everyone, those institutions will have to be radically altered because everyone simply cannot fit into universities organized around the traditional concept.

Which of these two fundamentally opposed means of broadening our presently too-narrow paths to maturity should society adopt? And how is this subject related to the high level of teenage unemployment among non-college ghetto residents? Some people believe much of that unemployment is a voluntary manifestation of the same withdrawal from the labor force that higher-income young people carry out by attending college. These and dozens of other vital questions require a new mode of approach which can take into account social values, use simulation of alternative institutional structures, and employ wisdom as well as observational skill and analytic excellence.

### **The Character and Organization of Research**

The key issues which I have described can be effectively studied and analyzed only through the use of certain methods and techniques which I believe are now "underemployed" in urban affairs. Such research must first of all be highly policy-oriented. Policy orientation in turn implies a great deal of simulation of possible alternatives, explicit grappling with questions of human and social values, and a willingness to deal with highly controversial subjects.

Second, research on these topics must be multidisciplinary. The real world pays no attention to the intellectual strait-jackets of academic departmentalization. Frankly, I have long been a nonbeliever concerning the ability of universities to perform team-oriented, multidisciplinary research. The intellectual atmosphere of universities has in the past attracted mainly individualists, as perhaps it should. Hence most academic researchers do not like to merge themselves into larger research teams. One reason for this is that academic professions do not reward people for research-team participation nearly as much as for individual brilliance, however useless it may be in relation to the major social problems of the day. If academic teams will not work, then within the academic community, and perhaps

generally, individual researchers must themselves become more multidisciplinary in their knowledge and capabilities. Moreover, a high proportion of the most meaningful research on the issues I have described will have to take place outside of universities in organizations where research is a full-time profession and team disciplines can be sustained. That may sound like a commercial for my own type of enterprise, but it reflects my honest opinion.

A third characteristic of research on the topics I have described is that much of it must be conducted at a very large scale of fact-gathering and analysis. Many of these topics can be studied only by surveying ideas, values, media impact, and other phenomena in relatively large sample populations. This means that a great deal of money must be spent in order to study these topics. Yet, contrary to the opinions of many who do not really know much about urban research, and in spite of the tremendous attention which urban and other social issues claim in the media, very little money is spent on it in the United States. The United States will spend about \$20 billion on research and development this year, but only a tiny fraction will go into the kinds of "software" analysis I have described. For example, the Department of Housing and Urban Development spends less than \$60 million on research each year. Moreover, the most influential officials in the Congress and the present administration, with a few notable exceptions (such as Donald Rumsfeld of the Office of Economic Opportunity), have by and large not yet realized that it is the institutional side of our urban problems, rather than the hardware or technological side, that now needs the most research. They have also not yet learned that such research can be quite expensive.

The final characteristic of the research topics I have described is that they are inherently controversial in nature. They involve the most essential and profound elements of our lives. So whatever we find out about them, the results will undoubtedly disturb millions of people and bring the white heat of politics to bear upon the researchers. That situation makes life much tougher, more morally ambiguous, and even more intellectually threatening than ever before for researchers and for universities. But these are precisely the prices of becoming "relevant" in the true sense of that word.

And I believe that many of us in the social sciences must seek to become more relevant. We must become more concerned with both truly understanding and responsibly analyzing the central issues of our society—rather than pursuing methodological trivia or exploring curious byways. Otherwise, it is all too easy for many elements in society—including academicians—to engage in heated but erroneous rhetoric, to display irresponsible intellectual pyrotechniques, or in other ways to betray their commitment to truth.

Unfortunately, one net effect of the four research characteristics which I have described is a strong tendency to discourage possible sources of research funds from investing in efforts to study these most vital subjects. Congress naturally tends to shy away from research projects which are expensive, controversial,

and deal with fundamental value questions—particularly when it is hard to demonstrate any immediate practical results emanating from such research. Foundations—for the same reasons and especially because of recent legislation—have become uneasy about policy-oriented research on controversial topics. They, too, are shifting towards more immediate-action orientation, whereas some of the subjects I have described can only be investigated through what amounts to "basic" or "pure" research.

Thus, ironically, the kinds of research we most desperately need to help solve our most severe urban problems are precisely the kinds we are least willing to finance. In fact, the same thing can be said of the kinds of policies and programs we most need to solve those problems. I do not know of any easy way to resolve this dilemma. My own contribution in this paper is trying to illuminate its nature, and thereby I hope minutely shifting prevailing opinions among funding sources towards a greater willingness to recognize and finance these types of research.

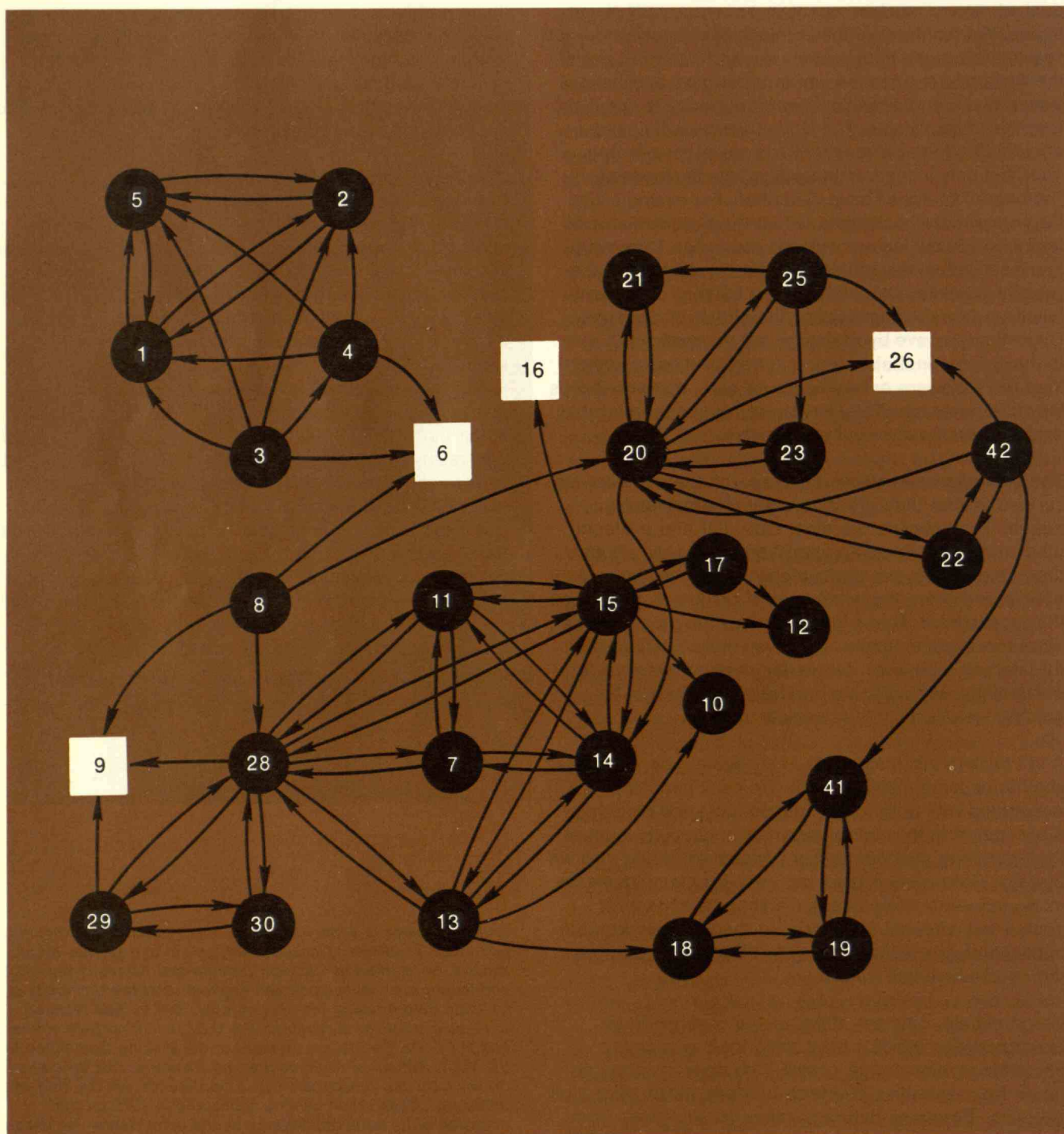
### **"We Have Met the Enemy, and He Is Us"**

In the long run, we in the social sciences must steel ourselves to be objective and truthful in the heat of these controversial topics. We must also devote our resources and intellectual energies to pursuing them in spite of personal disadvantages and pressures. Otherwise we will condemn ourselves to either of two unsatisfactory alternatives. One is retreating to the secure social obscurity of counting trivial angels on the heads of methodological pins. The other is gaining the fleeting fame of flaunting sensational but erroneous rhetoric about our problems—while failing to organize the hard-won resources or display the patient persistence needed to cope with those problems effectively. Thus, as we examine the difficulties of actually performing the kinds of research concerning urban problems which we most need, we finally confront our own ambiguities and weaknesses as researchers. As that great American comic-strip philosopher Pogo said about racism, "We have met the enemy, and he is us." So it is only *us* who can decide what to do about urban research, and do it effectively.

*Anthony Downs is widely known as a consultant on community and urban problems to government, public and private organizations. He studied at Carleton College and Stanford University and taught political science and economics at the University of Chicago before taking his present post, and he has lectured at many institutions throughout the U.S., including both Harvard and M.I.T. Dr. Downs is a member of the Visiting Committee to the M.I.T. School of Architecture and Planning; this article is drawn from his presentation to a conference on the role of university-based urban centers sponsored in 1970 on the occasion of its tenth anniversary by the Joint Center for Urban Studies of M.I.T. and Harvard.*



Every research and development organization has its internal, unofficial communication network—the pattern of interpersonal relationships which emerges when scientists name their “most frequent” discussion partners. Each numbered center below represents one individual; the number of entering branches shows the number of people who turn to a given individual for information; individuals with many such entering branches are classed as “communication stars.” In this network, based on the authors’ research in the laboratories of An Foras Talúntais, the Irish Agricultural Institute, numbers 14, 15, 20, and 28 are considered such “communication stars.” (Circles indicate scientists who responded to the authors’ questionnaire; squares indicate nonrespondents.)





The international transfer of technology takes place through intermediary agents called technological gatekeepers. For greatest effectiveness, these men must be well integrated both into an external network of information sources and an internal network of users to whom the information can be delivered

Thomas J. Allen,  
James M. Piepmeier, and  
S. Cooney  
Sloan School of Management, M.I.T., and *An Fortas*  
*Talúntais*

# The International Technological Gatekeeper

A great deal of attention has been devoted during the past decade to the problems of economic development and to the implications of the so-called information explosion in science and technology. Far less consideration, however, has been given specifically to the point at which these two areas intersect.

The problem posed by this intersection can be stated quite simply: A massive body of technical information exists in the world, and it continues to multiply and accumulate at a rapid pace. Somehow, a developing country should be able to tap this body of information and apply it in its own development programs. To reap the greatest benefits, the country must select and apply this technology efficiently. How, then, does the scientist or engineer working in a developing country with modest resources isolate and identify those pieces from the vast reservoir of the world's accumulated technical knowledge that are relevant to his current work? How, indeed, can he even discover whether his particular problem has already been solved by a researcher elsewhere?

Many authors have already pointed out that all research and development suffers from its inability to answer these questions. But the symptoms are likely to be much more acute in a small country with limited resources. Such a country can ill afford duplication of research. So it is important to consider how scientific and technological information flows between countries, and how we may improve the communications channels that carry information from research groups in one country and deliver it to research groups in another (particularly a developing) country.

## Interorganizational Transfer of Technology

Before examining the channels used in international technology transfer, it will be useful to look at an analogous situation which is somewhat better understood. The large, technology-based firm faces a problem very similar to that of the small country. No single organization can be technologically self-sufficient; it must always import relevant technology, and its effectiveness in doing this may be a key factor in the organization's success.

Most attempts to describe how new technology enters the firm have assumed a straightforward model of information flow. According to this model, the interface

between technical personnel in the firm and the external technical environment is a simple and direct one; each member of the organization accomplishes this interfacing in exactly the same way: he reads the literature, and he talks with people outside of the firm. To promote technology transfer under the terms of this model, all one must do is increase the degree and ease of contact between organization members and the two external information sources, people and literature.

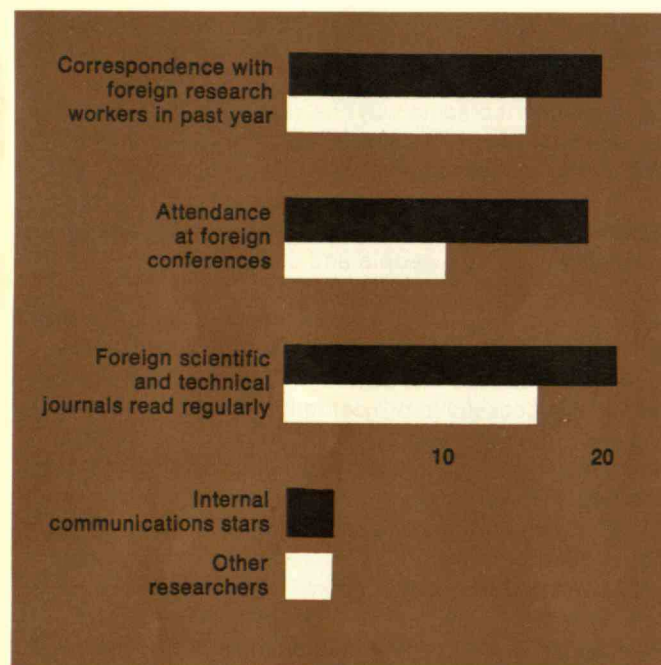
Although in theory this is very simple, in practice it often becomes very costly and is frequently ineffective. Indeed, research now shows that neither of these sources has been successful in providing information to the average industrial scientist or engineer. The literature is ineffective because the average engineer makes very little use of it—particularly that contained in professional engineering and scientific journals—and increasing its quantity will be ineffective because he already feels swamped by written material. Though it may occur frequently, direct contact with people outside of the organization is ineffective; studies have shown a consistent negative correlation between the use of this information source and the user's performance. The channel is a "noisy" one, subject to misinterpretation, and is, therefore, an ineffective medium for technology transfer.

There is only one information source whose use has consistently shown a positive correlation with technical performance. It lies not outside the firm, but within. Certain colleagues of the information seeker within his own organization prove to be the most effective direct source of information. These colleagues, highly regarded as internal consultants, are shown to make significantly greater use than their associates of the professional and scientific journals and to maintain ongoing informal contact with many colleagues in other organizations, particularly university and nonprofit laboratories. They thus serve as intermediaries between the average member of the firm and external sources of information, and we have given them the name "technological gatekeepers" (see *"Communications in the Research and Development Laboratory"* by Thomas J. Allen in *Technology Review* for October/November, 1967, pp. 30-37).

The technological gatekeeper receives information from a wide variety of sources external to his organization



Internal "communication stars" (dark bars) receive significantly more international technical information than "non-stars" (white bars) through all the traditional media—correspondence with foreign colleagues, attendance at international conferences, and reading in foreign journals.



and acts as an information source for his colleagues in his group. Such a two-step flow seems to be significantly more effective in transferring technology than a simple direct connection from source to receiver. In at least some organizations, gatekeepers have actually developed a network among themselves to extend considerably the range of contact between organization members and sources of information in the world at large.

A similar phenomenon has been shown to play an important role in communications over a wide spectrum of human effort including the adoption of hybrid seed corn by farmers, the prescribing of new drugs by doctors, and the spread of political opinions among the electorate. It is not surprising, therefore, that the same two-step process has now been suggested in connection with technology transfer among nations.

### International Technology Transfer

As a first step in studying such international communication, we have made an empirical analysis of the way in which foreign agricultural information is acquired by one small country and then disseminated among its agricultural scientists. This study hypothesizes that communications channels for the international transfer

of technical information will also demonstrate a two-step flow process and that "international technological gatekeepers" can be isolated and identified as key intermediaries through which information from abroad is channeled and distributed.

The sample population in our study comprised the native-born personnel of *An Foras Talúntais* (A.F.T.—the Irish Agricultural Institute), including research personnel and first- and second-line supervisors—but not technicians. Those who reported spending less than 10 per cent of their time on research and development were also removed from the sample.

*An Foras Talúntais* operates under a charter similar to that of many other government-supported research institutes. One of its primary goals is the acquisition of information to promote agricultural innovation as a means toward the economic and social development of the nation. It therefore acts in one sense as a gatekeeping institution, mediating between the Irish farmer and agricultural developments occurring both within and outside of the country.

The research personnel of A.F.T. are overwhelmingly Irish by nationality (95 per cent are citizens of the Republic of Ireland or Northern Ireland). The sample population of 180 scientists contained 55 Ph.D.'s; most of the remaining held a degree or certification higher than the bachelor's level. Our study was based on a brief questionnaire administered to all scientists in *An Foras Talúntais*. In addition to the usual demographic and biographic questions, the respondents were asked to name the people both within and outside of A.F.T. with whom they most frequently communicated on scientific matters, and to estimate the intensity of their foreign correspondence over the past year.

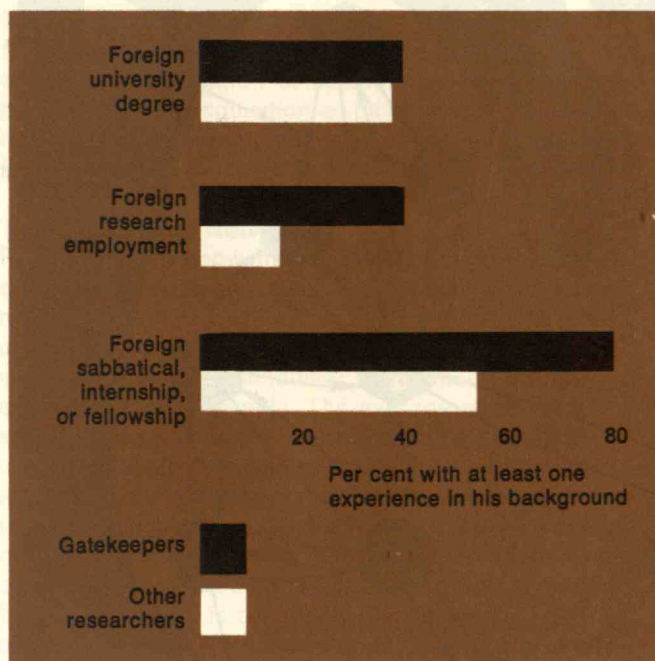
### Choosing International Gatekeepers

To be an effective gatekeeper in an international sense an individual must be well integrated into two networks: an external network of foreign information sources and an internal network of domestic users to whom the required information can be delivered.

The structure of the internal communication network can be approximated by examining the responses to the question in which "most frequent" scientific discussion partners are named. Each respondent is thus connected



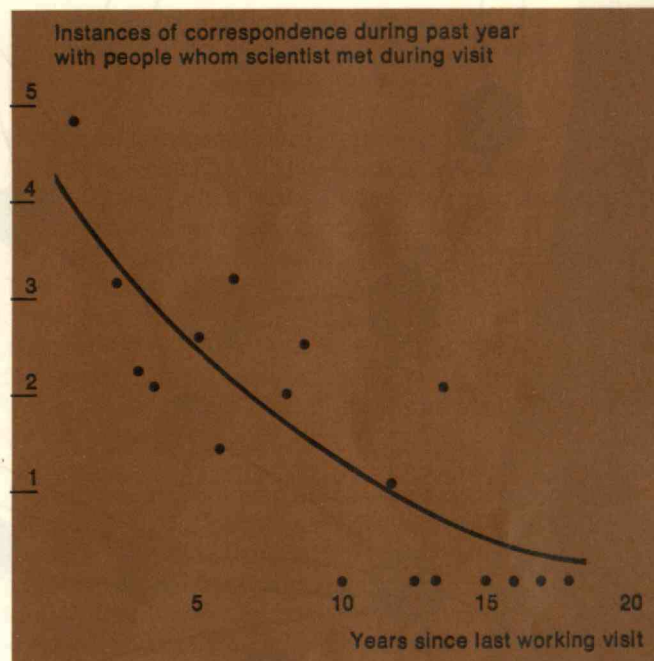
*A very high proportion of the gatekeepers in A.F.T. have held temporary sabbatical or fellowship appointments in foreign countries; foreign undergraduate or graduate study is not nearly so effective in determining whether or not an individual will become a gatekeeper (left). The effectiveness of an overseas appointment in stimulating foreign correspondence declines rapidly with the passage of time (right).*



to those whom he names. The diagram of such responses (page 36) exposes for each person the number of entering branches—an index of the number of people who turn to a given individual for information, or the number of people who can potentially be reached by information held by that person. A person with a large number of entering branches is likely to be a very important source of information for his colleagues in the organization; we call him, for purposes of the present study, a “communication star.”

For such a “communication star” to also be a “technological gatekeeper” he must be well integrated into an external network of foreign information sources; he must use the network regularly, and his network must be broad enough to include a diversity of such foreign sources. Two criteria—the frequency of foreign technical correspondence and the frequency of foreign scientific and professional meeting attendance—were used. Each of these channels can be used frequently, and each allows contact with a large number of overseas colleagues. The degree to which they are used is therefore judged to be a good measure of integration into the external network.

The concept of the “technological gatekeeper” can be

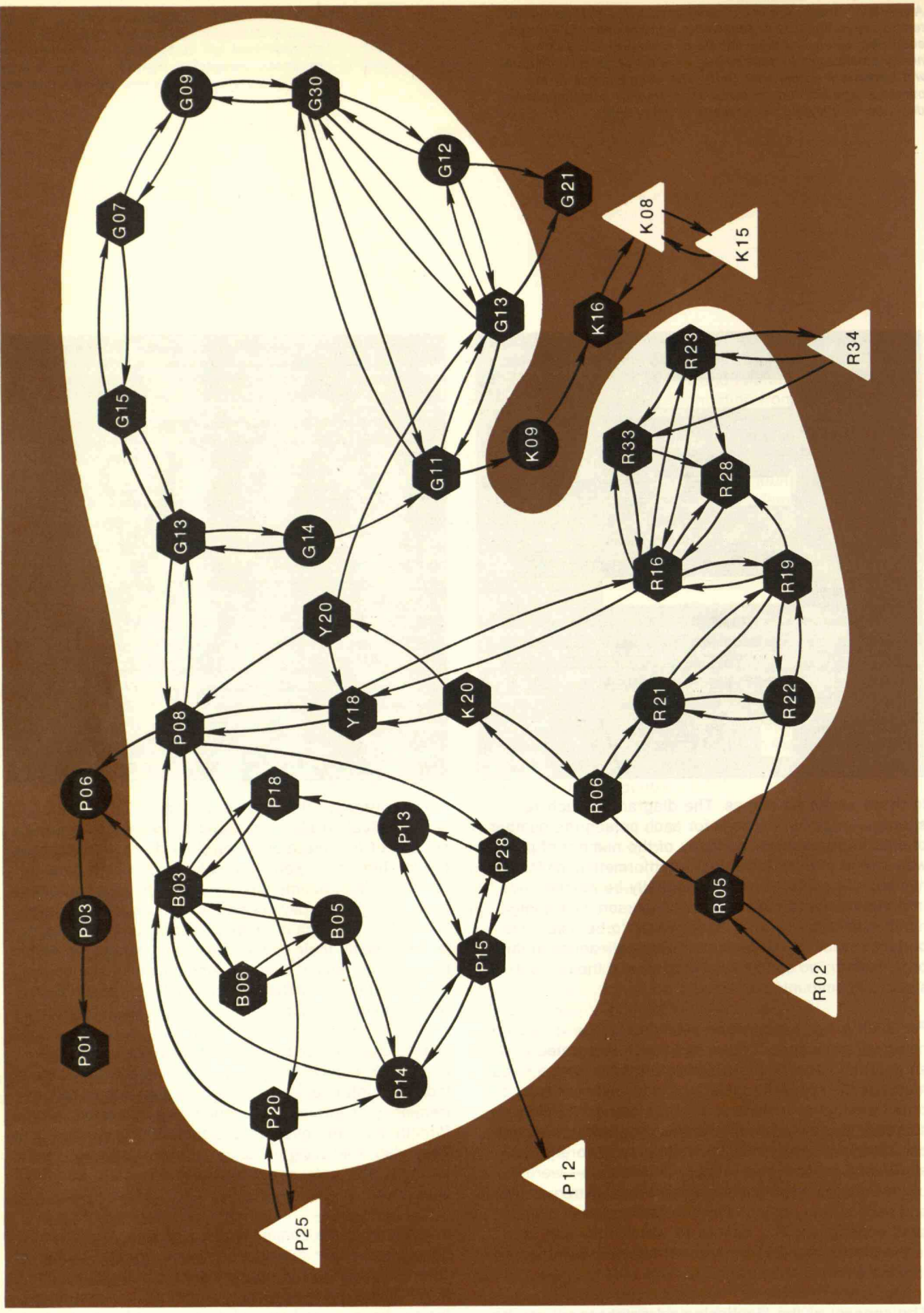


proved operative if it can be demonstrated that the “communication stars” actually do receive a greater amount of foreign information than do their colleagues. If each individual were to receive most of his foreign technical information directly from its source (direct flow), the gatekeeper concept would be meaningless. Similarly, if the high international communicators were isolates within their country, the gatekeepers would be nonexistent. Simply stated, a single individual must be instrumental in both the acquisition and dissemination of foreign information.

In fact, the data show that technical discussion stars actually do receive significantly more international technical information than nonstars as measured by frequency of foreign correspondence and attendance at foreign scientific and professional society conferences. They also read a significantly greater number of foreign journals. The gatekeeper hypothesis is quite strongly supported.

In addition to his communication activity, the international gatekeeper displays somewhat greater technical competence than his nongatekeeper colleagues. Those in A.F.T. are, on the average, significantly superior to their colleagues in both publications and patents, and a







Out of the pattern of laboratory communication the authors identify a network of most-used communication channels for information about foreign scientific activities—the central white area—which has developed within the research laboratories of An Foras Talúntais. The hexagons indicate true gatekeepers—"communication stars" with extensive foreign correspondence—in this network, the circles are "star" members of the network who do not qualify as foreign gatekeepers, and the triangles foreign nationals attached to the organization who have achieved the closest connections with the gatekeeping network. The network is remarkably independent of geographical constraints; each prefix letter indicates a different one of A.F.T.'s seven research laboratories (individuals with the same prefix letter are at the same location). All the centers are represented in the gatekeeping network.

higher proportion have a Ph.D. degree. Technical performance is extremely difficult to measure, but to the extent that publication of scientific and professional papers and the acquisition of patents serves as an indicator, the international gatekeeper is a high performer indeed.

### The Gatekeeper Network

Recent studies show that in American research laboratories gatekeepers often develop tightly connected networks of their own within each laboratory's communications network. Such a gatekeeper network provides an effective mechanism for coupling the laboratory to outside events. The average engineer or scientist now has more than just a single intermediary to provide him with outside information; he has instead an entire network. Information which enters the organization through one of the members of the network (a gatekeeper) is transmitted quite readily to other members of the network as a result of their high level of interaction, and it is eventually disseminated to the rest of the laboratory. This final step in the process is possible because nearly everyone in the organization is in direct and frequent contact with one or more of the gatekeepers.

In *An Foras Talúntais*, there are 26 scientists whose communication activities fit the operational definition for a gatekeeper. All but four of the 26 are members of a single subset of the total network in which all members are mutually reachable. This group represents a very highly connected portion of the total network; whose members are in close and frequent contact with one another. But even the four gatekeepers who are not members of the strong component (the illustration opposite) are not very far removed from it. For this reason, it can be argued that all 26 gatekeepers have developed for themselves a fairly cohesive network. The existence of the network is still more impressive when one considers the barriers to its formation. *An Foras Talúntais* is divided into six divisions, and the scientific activities of these six divisions are conducted at seven major locations spread over a large geographic area within the country; the distances between centers range from 15 to more than 150 miles. The gatekeeper network extends over all of the centers, and it is clear that organizational and geographic dispersion are not insurmountable barriers to communication among gatekeepers.

The gatekeeper network thus formed serves as a vital mechanism for bringing foreign science to bear upon the agricultural problems of Ireland.

### Developing International Gatekeepers

Given the existence of gatekeepers at an international level and their importance in coupling the country to foreign science and technology, the important problem now becomes how to develop people into this role. There are many possibilities. A scientist might develop contacts through foreign education and maintain these after returning home. Or a scientist imported from a foreign land might retain contacts in his home country, thereby establishing himself as a potential gatekeeper for the host country.

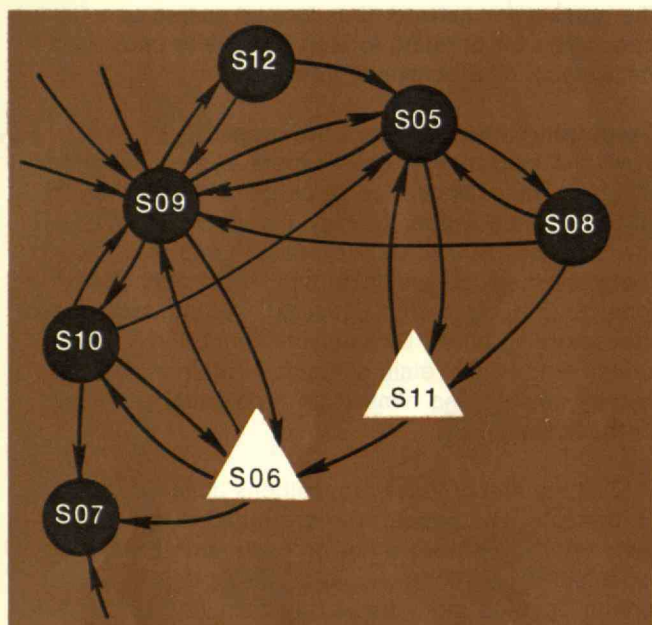
At least the first of these propositions does not appear supportable. The people who are functioning as gatekeepers for A.F.T. were not predominantly foreign-educated. Proportionately, gatekeepers do not hold foreign degrees more frequently than do nongatekeepers. Foreign education simply does not appear to be an effective strategy for creating gatekeepers.

Employment in research in another country is, however, quite effective. A very high proportion of the gatekeepers (89.3 per cent) have either been employed by a foreign agency or firm or have visited another country to work on a sabbatical or research fellowship; it is clear that far more enduring relationships can be established during postgraduate research than during the educational process. A government wishing to establish foreign communication channels would, therefore, be well advised to support the graduates of its own universities for short periods of work abroad rather than to support its students in foreign education at undergraduate or graduate levels.

The effectiveness of foreign visits in promoting communication is, as expected, a decaying function of time. Unless given an opportunity to renew acquaintanceships, a person's level of foreign communication will steadily decline with time. Present data suggest that scientists who are to function as gatekeepers should be encouraged to participate in foreign sabbaticals every five to ten years. International conferences certainly have a potential for offsetting this decline, but how effective they are in maintaining these communication channels remains to be determined.



Though foreign nationals employed at A.F.T. are not typically part of the principal gatekeeper network, they are closely associated with two cliques formed around three "communication stars" (S05, S09, and N08) at two A.F.T. centers. This connection into the communication network is not as effective for international technology transfer as would have been a full participation in the gatekeeper network, but it assures local dissemination of their special competence.



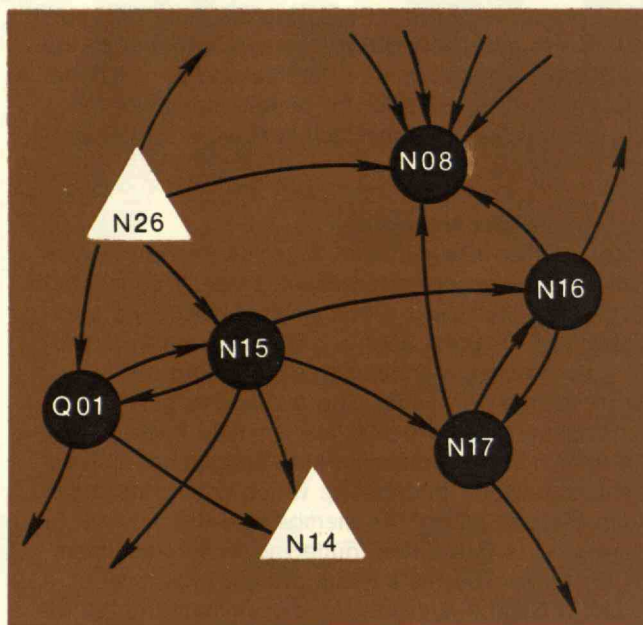
### The Position of Foreign Nationals

Ten scientists in the A.F.T. sample are citizens of foreign countries. While this is a small basis from which to generalize, the importance of the question of foreign nationals' effectiveness in bringing science and technology into a country is so great that we would be remiss in not considering it.

None of the gatekeepers is a foreigner. Although the ten foreign nationals all exhibit a high degree of communication with scientists outside of the country, none is an internal communication star. They are all well-integrated into the domestic communication network but none to that exceptionally high degree required of a gatekeeper.

The data make it clear that not all foreigners can be expected to become gatekeepers, and none can be expected to accomplish this feat overnight.

Does this mean that foreign scientists are not fully effective in the technology transfer process? Six of the ten have attached themselves in a very direct fashion to the gatekeeper network. They are in a position to feed any information which they obtain directly into the system with a very high probability of reaching the parties who most need it. The best compromise may



be that which is revealed above—to bring foreign nationals into direct contact with those members of the organization who have the widest range of domestic contact. In this way, the number of people who have at least indirect contact with the foreigner is maximized. The members of the gatekeeper network are, naturally, in the best position to serve as a buffer stage between the foreigner and the organization. They may also be better equipped to aid the organization in assimilating the foreigner. They have usually been exposed to cultures other than their own, and have perhaps had experience in a specific foreigner's own country. They are therefore better able to understand and communicate with their foreign colleagues and to make this expertise relevant to the problems of the country.

How can laboratories best capitalize on foreign participants in the absence or unavailability of gatekeepers? The best tactic appears to be to provide the foreigner with a close associate who, although not a gatekeeper, is integrated into the domestic network to an exceptionally high degree. This is just what happened in the case of the four foreign nationals at A.F.T. who were not connected directly to the gatekeeper network. They were employed at two centers not heavily represented in that network. All four associated themselves with two cliques that had formed



# Research, Technical Progress, and Economic Growth

around three internal "communication stars," thus at least assuring that their competence would be well disseminated within their respective centers.

## Fostering International Technology

The existence of the international technological gatekeeper as an intermediary in the technology transfer process has now been clearly demonstrated. The international gatekeepers display characteristics which are very similar to those found in American research and development laboratories. They are, on the average, technically more competent and more productive, holding Ph.D. degrees significantly more frequently than their colleagues. They regularly read a large number of technical publications.

The international gatekeeper's ability to keep abreast of foreign technological developments is an effective way for a country to import technological information. It also appears to be a relatively inexpensive way: the cost of allowing a gatekeeper to maintain his foreign contacts through periodic travel is quite small. The present evidence indicates that the gatekeeper develops his external contacts most effectively through active research experience in a foreign country. Much more enduring relationships seem to be established during a year of postgraduate research than are established during several years of education.

The implications of these results are unambiguous. If international transfer of technology is to be fostered, the small nation should seek to open those channels through which information flows most effectively. It should assist able, domestically educated research personnel to do research abroad. It should encourage researchers to have foreign sabbaticals, fellowships, and other forms of extended foreign technical experience. It should not, however, spend money directly on foreign education for its personnel. It should help gatekeepers to perform their role as an efficient mechanism for transfer by providing funds to maintain existing contacts through foreign travel. It should stimulate the clustering of gatekeepers into tightly connected networks so that information entering through a single gatekeeper can eventually reach almost any person needing it after being transmitted along the gatekeeper network. It should use care in integrating foreign scientists so that they are located at points from which their expertise can be widely disseminated by colleagues.

The gatekeeper phenomenon is certainly not the complete answer to all of the small nation's problems in bringing new technology to its development efforts. But an understanding of the gatekeeper process coupled with a willingness to capitalize upon it will certainly be a long step in this direction, and it may be the least expensive of the several options available.

## Suggested Readings

James M. Piepmeier, unpublished S.M. thesis, Sloan School of Management, M.I.T., 1970.

Thomas J. Allen, "The Performance of Information Channels in the Transfer of Technology," *Industrial Management Review*, Number 8, 1966.

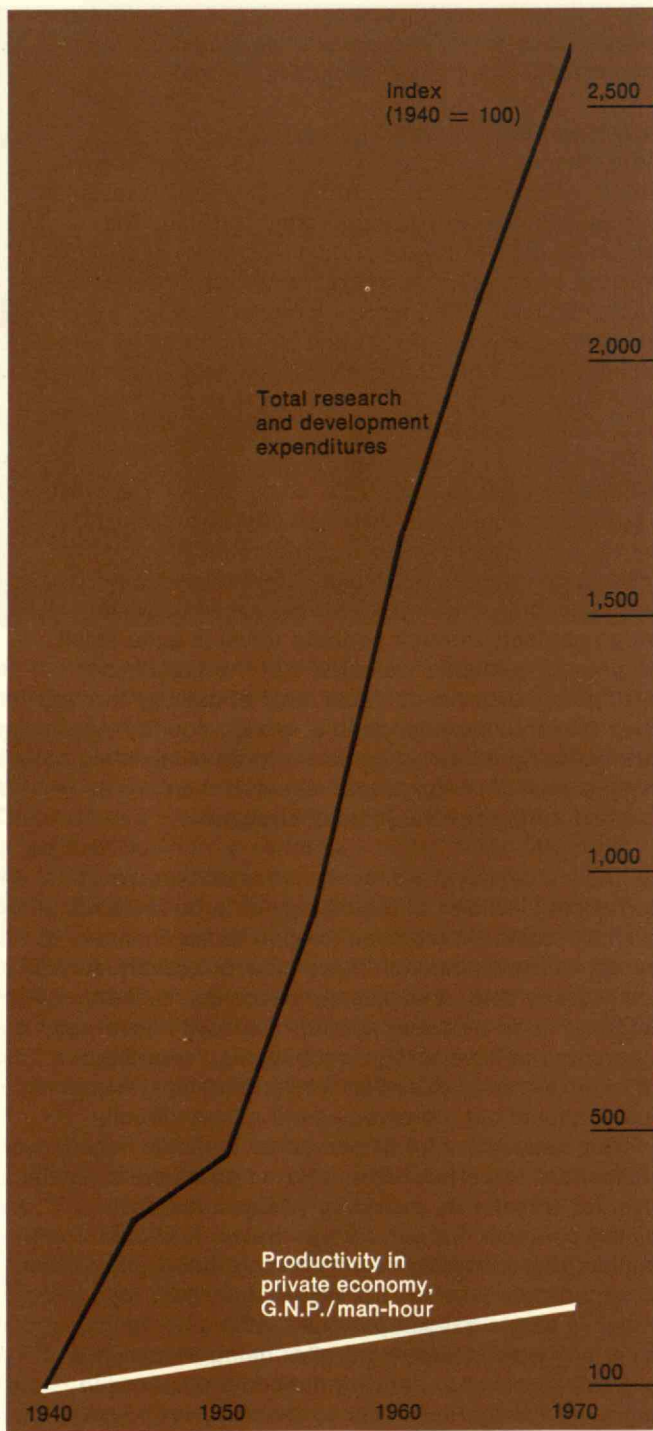
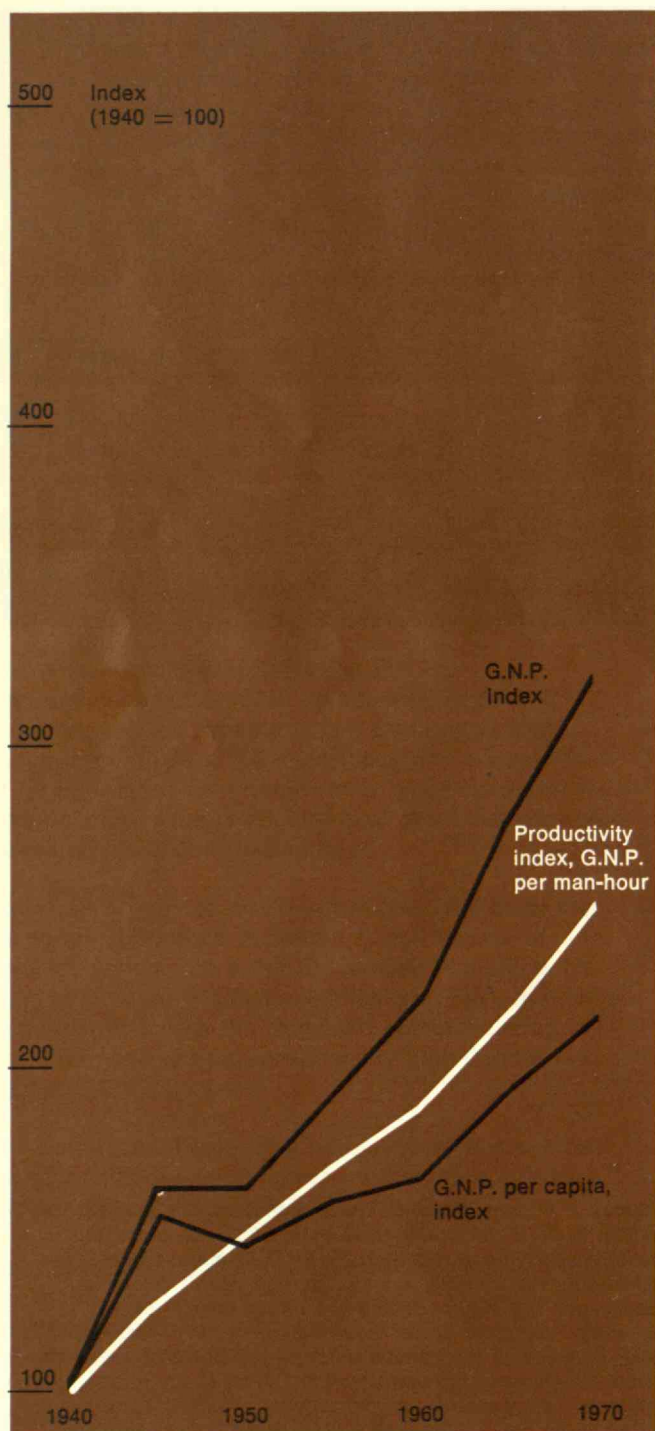
D. Katz and R. L. Kahn, *The Social Psychology of Organizations*. New York: Wiley, 1966.

Thomas J. Allen and S. I. Cohen, "Information Flow in R & D Laboratories," *Administrative Science Quarterly*, Vol. 14, 1969.

Thomas J. Allen, "Network Analysis in R & D Laboratories," *R & D Management*, Vol. 1, 1970 (in press).

Thomas J. Allen was trained as an electrical engineer before coming to M.I.T. for graduate study in 1963; he joined the Institute faculty upon receiving his Ph.D. from the Sloan School of Management in 1966. A major portion of this paper is based upon the Master of Science thesis completed by James M. Piepmeier at the Sloan School in 1970; Mr. Piepmeier is now with the London office of the Boston Consulting group. Mr. Cooney is the Information Officer of An Foras Talúntais. The research on international gatekeepers was supported at the Sloan School by a grant of An Foras Talúntais, the Irish Agricultural Institute, and the authors acknowledge the cooperation of the management and employees of A.F.T.

The curves on the left show economic growth (measured as G.N.P., and as G.N.P. per capita) and productivity, all relative to 1940. Those on the right show the growth of research and development expenditures, relative to the same year, with the productivity line redrawn to the same scale for comparison. The growth of research and development (see also p. 48) is seen to be of a quite different order from the other measures; in the text, an attempt is made to discover connections between them.





The growth of the economy is presumed to be strongly influenced by research expenditures. A determined analytical search for the connection, however, yields less real evidence than we might expect

Lester C. Thurow, Professor  
of Management and Economics, M.I.T.

# Research, Technical Progress, and Economic Growth

What are the connections between research expenditures, technical progress, and economic growth?

Before I attempt to answer this many-sided question, let me remove any possible confusion between the notion of economic growth—which will be one of our central concerns here—and “progress,” a more nebulous idea which is sometimes equated with it. “Progress” can be measured along a number of dimensions—economic, political, social, cultural, spiritual. If it were possible to devise some comprehensive measure of social welfare, economic progress would be only one aspect of it. Economic progress is not man’s highest art form. It merely makes other activities possible.

Economic growth is only one component of economic progress. This article is not an argument for economic growth; it is an analysis of economic growth. Aspects of economic progress that are not measured by economic growth include the *distribution* of income and of employment opportunities, for instance. Economic growth merely indicates an increase in the quality and quantity of goods and services that an economy as a whole is capable of producing. Thus, it is not suggested that economic growth is the only kind of progress.

The analysis will proceed by looking first at the links between research expenditures and technical progress, and then at the links between technical progress and economic growth. “Technical progress” is measured by the growth of output per man-hour; economic growth is measured by the growth of the Gross National Product. Since misinterpretations of both of these measures abound, both will be explained.

World War II provided the initial impetus to research expenditures, reinforced later by the Russian Sputnik. In the 39 years from 1940 to 1969, research expenditures rose over 26-fold, from (in constant 1958 dollars) \$0.8 billion to \$20.5 billion (see charts opposite and page 48). In the same time, productivity per man-hour rose by 144 per cent, the real Gross National Product rose 220 per cent, and the per capita G.N.P. rose 108 per cent. As a percentage of the Gross National Product, research and development rose from 0.3 per cent to 3.0 per cent in the mid 1960’s, and then started to decline to 2.8 per cent in 1969.

In general usage, “technical progress” is a vague term

for scientific and engineering advances; but it is a precise technical term in the vocabulary of the economist. Technical progress takes place whenever increases occur in the units of output produced per unit of input. Given a social interest in individual welfare, this measure becomes G.N.P. per man-hour, often referred to as productivity per man-hour. The aim of such a measure is to indicate how many hours of his time a man must sacrifice to produce a given quantity and quality of goods and services; the less sacrifice, the better.

In the post-World War II period, productivity per man-hour grew 3.4 per cent per year—on average, but it ranged widely, from 9.2 per cent in 1950 to 0.1 per cent in 1956 (see page 48). The variation reflects the impact of business cycles. Technical progress is found by dividing total output by total man-hours. During recessionary periods, overhead labor is not fired as quickly as output falls, so measured productivity declines—more labor is used per unit of output. Likewise, when the economy is recovering from a recession, overhead labor is not added as quickly as production increases, and the result is a rapid increase in measured productivity. Analysis of technical progress must allow for the impact of business cycles, and look at what is happening to productivity when the economy is operating at full employment.

## Research Expenditures and Technical Progress

But what is the connection between technical progress and research expenditures? In theory, research should lead to new products, better products, or better ways of producing old products. If research leads to new products or better products, it raises the output per unit of input. If it leads to better techniques, it lowers inputs (man-hours) necessary to produce old products. In either case research leads to a higher measured productivity.

Perhaps the relationship can best be understood in the context of the following model. Assume that knowledge is arranged in a continuum from the most productive technique to the least productive technique. (Similar continuums could be constructed for product innovation or improvement.) On the far right there is a frontier of scientific knowledge. Well behind this there is a frontier of engineering knowledge, and well behind this there is a frontier given by the best actually operating technique (see page 49). But all plants do not use or even know



about the best operating techniques. To the extent that the best techniques must be embodied in physical capital, they cannot use the best techniques without scrapping all of the old plant and equipment and buying new.

Typically the spectrum between the highest productivity plant in operation and the lowest productivity plant in operation covers a range of productivities on the order of four to one, with a distribution of plants in between. To the left of the worst operating plant is a range of techniques that have become obsolete. The distribution curve is moving to the right (as are the various frontiers) with respect to any particular technique.

For the purpose of interpreting this picture in terms of productivity, the relevant factors are the range between the best and worst practice plants, the distribution of plants within this range, the location of the range on the continuum, and the speed with which the whole distribution is moving to the right. The frontiers of engineering and science are relevant only in that they are a kind of road-building operation, whose speed limits the possible speed of movement toward higher productivity techniques.

To some extent, the recent cut-backs in research funding by the Nixon administration have been justified by the idea that the frontiers of scientific and engineering knowledge have been advancing to the right much faster than the distribution of operating techniques. It follows that funds for scientific and engineering advances should be cut while more emphasis is placed on using the scientific and engineering advances that have already been made. If this view were realistic, it would be possible to accelerate technical progress while at the same time cutting back on funds allocated to research.

Several comments must be made about this hypothesis. First, no one knows whether the frontiers of science and engineering are now farther ahead of the frontier of operating techniques than they have been in the past. No one knows, because no one has a method for measuring such a distance. Second, no one knows what the relation is between the speed of movement of the distribution of operating techniques and the speed of movement of the frontiers of science and engineering. Does a big gap engender a more rapid movement to the right (rather as, in foggy weather, one would drive faster if one could see farther) or does the distribution of op-

erating techniques move at its own pace regardless of the pace of engineering and scientific advance?

One empirical observation is possible. Measured rates of growth of productivity do not seem to have increased with the acceleration of research expenditures during World War II or with the acceleration of research expenditures in response to Sputnik. Economic historians are in disagreement as to whether postwar productivity is growing faster than prewar productivity; if there is a difference, it is very slight. No one maintains that there has been any increase in the rate of growth of productivity after the Sputnik jump in research expenditures. There is also no evidence of any gradual acceleration of productivity during the postwar period.

### Why So Slow?

There are several alternative hypotheses for explaining why productivity has not grown faster. First, the acceleration in research expenditures has been heavily concentrated on defense and space applications. The technical requirements in these areas are far enough removed from everyday civilian activities so that improvements in these directions have little or no civilian applicability. Certainly no one has been able to find any substantial civilian spin-off, even though various groups have tried. Individual products can be found, but they are too small in volume to have had a measurable impact on productivity. Thus, most research has not led to a faster rate of technical progress; but neither was it designed to do so.

Second, the rate of change in operational techniques may be independent of the rate of movement of the frontiers of engineering or scientific knowledge. Potential improvements may be kept from realization for institutional reasons. This may mean that more resources need to be devoted to ensuring that existing (and growing) knowledge is used; but it may also mean that those institutions that are resistant to improvements need to be altered. A new construction technique which would increase productivity may be obstructed by unions. Whether such difficulties are grounds for *reducing* the rate of engineering or scientific progress is another, but related, question. Presumably there is little value in inventing new products or techniques that society refuses to use. In considering the cost of technical progress, we must evaluate research expenditures, utilization expenditures, and institutional changes as a single package. Each may be wasted without the other.

Third, scientific progress may simply have become more expensive, "per unit of progress"—that is, the rate of scientific, engineering, and operating progress may not really have increased at all, while the costs of obtaining this progress (which are what our statistics are about) have increased dramatically. We therefore have to spend more to guarantee the same old rate of progress. Thus, if the Nixon administration cuts back on research expenditures, the results will show up in a *slower* rate of measured technical progress in the future. (This reduction, however, may be many years in the future, if there is a substantial distance between operational techniques and the frontiers of engineering and scientific



knowledge.) Thus, if this notion is correct, research expenditures must be increased to maintain an undiminished growth of productivity.

Fourth, research expenditures may have been inefficiently allocated, and thus failed to produce the results that they can or should produce. In which case, research grants and contracts should be given with more of an eye toward efficient utilization.

Fifth, the time lag between discovery and actual implementation may be so long that the productivity consequences of postwar research expenditures have not yet arrived—the gains from research expenditures have yet to surface, but, in this view, they will. The implication is that research expenditures should be maintained as an act of faith.

At the moment no one can provide conclusive evidence for the acceptability of any one of these hypotheses, or any combination. In the short run, intuition and personal judgment are all we have to go on; in the long run, perhaps some rigorous explanation will be found for this seeming lack of a connection between technical progress and research expenditures (which are clearly connected in some way).

Until then, no one is in a position to provide a convincing *economic* argument for an increase in research expenditures, reduction in research expenditures, or for the maintenance of the current level. (My intuition, however, tells me that reasons 1 and 3 will prove to be the operative factors—recent research has been far removed from civilian usefulness, and has been more costly than in prewar years.)

We must now examine the link between technical progress—observable in the productivity figures—and economic growth, roughly observable in the G.N.P. This is the more complex half of the study.

### **Economic Growth: The G.N.P.**

Economic growth occurs whenever the economy expands its capacity to produce more goods and services of the current kinds, or produces new or better goods and services. Both of these types of growth are measured in the National Income and Product Accounts. When the hundreds of statistics in the National Income and Product Accounts are added together in the appropriate fashion they yield the Gross National Product. In the “good old days” it would have been unnecessary to explain or defend the Gross National Product, but fashionable talk about stopping economic growth makes such an explanation a current necessity.

Recently, I heard a scientist from Stanford University say that, if his audience were taken ill, the Gross National Product would go up (because of the consequent expansion in the medical sector.) Therefore, the Gross National Product was obviously meaningless if not perverse. The economic illiteracy in such a statement can only be conveyed by saying that it would be equivalent to my arguing that two people plus a see-saw represent perpetual motion. (The audience, ceasing to work, would lower the output of other sectors.) The

Gross National Product is not a perfect measure of economic growth, but its imperfections spring from real problems that have no easy solutions. It was not constructed in Alice’s Wonderland.

The Gross National Product attempts to measure improvements in the quality or quantity of goods and services, whether they be public or private, but it is faced with some practical measurement problems. Goods and services are valued at the price they bring in the market place. One problem is raised by goods and services that are not sold. In the private sector, these are principally do-it-yourself type activities, but they are nontrivial, especially the home services of housewives. Solutions have been suggested for this problem (“imputed rents,” etc.) but none of them have been compelling. All seem to raise as many problems as they solve. As a result, do-it-yourself activities have been ignored in the G.N.P. We await the man who discovers a compelling objective method of valuing his wife.

While the National Income and Product Accounts have some well-known weaknesses, they are not nonsensical. Most of the changes that all of us would agree are necessary to improve the quality of life would increase the G.N.P.—if more schools, homes, sewage disposal plants, mass transit, parks, and urban rebuilding are to be realized, the Gross National Product must expand. All of these items are, by definition, increases in the Gross National Product. An absence of growth would mean that none of these items could be expanded, except at the expense of current activities.

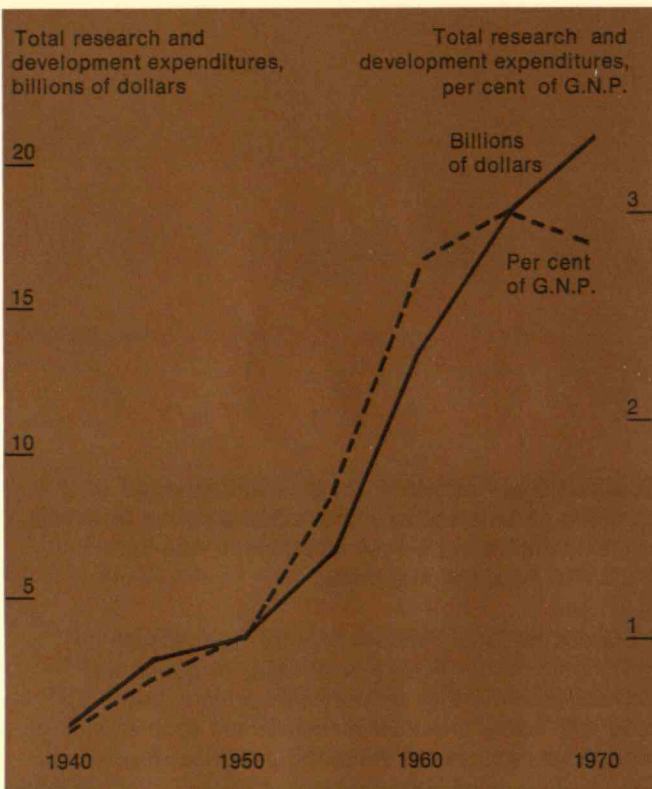
A high-quality life for all is not to be achieved merely by raising or lowering the G.N.P. It is a matter of social balance. The important questions are: do we have the goods and services that we need most? Do we have goods and services that we do *not* need? In some areas we need more, and in other areas less. But whichever is the case, the National Income and Product Accounts provide a detailed method of measuring the desired progression or retrogression.

Likewise, they make it possible to investigate the economic effects of research and technical progress.

### **Supply, Demand, and Unemployment**

Research and technical progress have an impact on the growth of the Gross National Product, but this impact





The chart shows research and development expenditures, both in absolute terms and relative to the G.N.P., since 1940. But the table shows that the rate of growth of productivity, measured as G.N.P. per man-hour, varies widely in response to the economic forces of the moment. This fluctuation in apparent technical progress complicates the search for underlying connections.

needs to be carefully delineated. There are two basic sets of factors that determine the output of an economy. On one side are the factors that determine a society's aggregate demand for goods and services. How much will each individual or group in society spend to provide itself with goods and services? On the other side are the factors that determine an economy's potential supply of goods and services, its production capacities. How much output will each individual or group be capable of producing? We shall consider the impact of technical progress on both demand and supply, in turn; they are subject to different influences, and become important in different economic conditions.

In periods of less than full employment only the factors that determine aggregate *demand* have an impact on the actual rate of growth of the Gross National Product—on the supply side, there is enough play to permit adjustment to meet demand. (Technical progress may actually be harmful in these conditions, to the extent that by raising productivity it raises unemployment even further.)

In periods of full employment, supply factors take over as the basic determinants of the growth of the economy. The actual level of demand is irrelevant (except in so far as it produces inflation), since in these conditions the economy is not responding to the demand for goods and services—it cannot grow fast enough to.

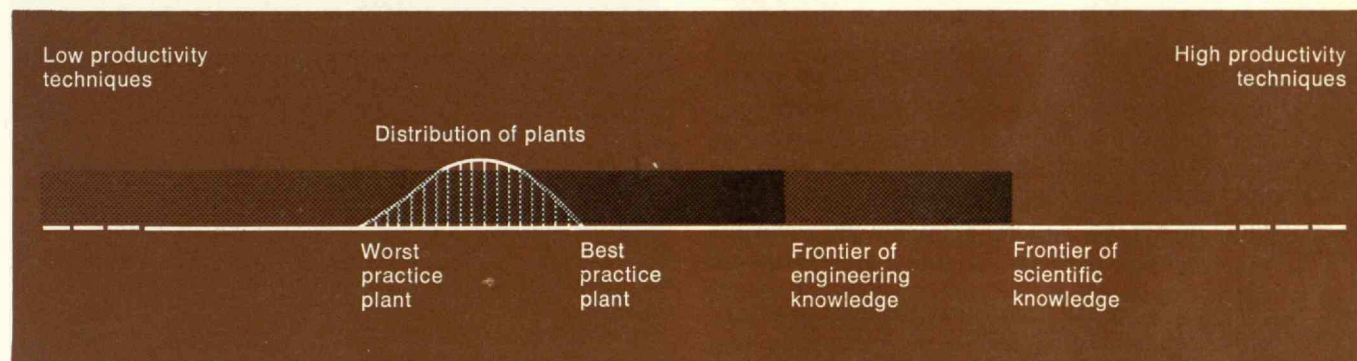
It is clearly impossible to isolate the impact of technical progress and research without specifying whether the economy is in a period of full employment or a period of underemployment. There is nothing in our economic system that insures that it will achieve full employment. The sum of all demands need not equal the sum of all the capabilities of production. Economic systems seem stable—there is always a point of equilibrium—but this equilibrium need not be at full employment. It is to constrain the economy to come to a stable equilibrium at full employment that public macro-economic policies (fiscal policies and monetary policies) are brought into operation.

Immediate difficulties are created by the definition of "full employment." This term is sometimes used to describe a state where men and machines are fully utilized; but it is also used to describe the economic policy maker's *desired* level of unemployment.

	Productivity index (G.N.P./man-hour)	Per cent change in productivity per man-hour in the private economy
1947	100	
1948	103.4	3.4%
1949	105.9	2.4
1950	115.7	9.2
1951	121.0	4.6
1952	124.5	2.9
1953	130.2	4.6
1954	133.7	2.7
1955	139.5	4.3
1956	139.5	-0.1
1957	143.3	2.7
1958	146.6	2.3
1959	152.5	4.0
1960	154.2	1.1
1961	158.4	2.7
1962	166.8	5.3
1963	172.3	3.3
1964	178.7	3.7
1965	184.6	3.3
1966	193.1	4.6
1967	197.0	2.0
1968	204.9	4.0
1969	207.1	1.1



Technical progress in industrial practice can be imagined as movement along a spectrum of productivity. Ahead of the existing industrial facilities are a frontier of as yet unapplied engineering knowledge and—according to this hypothesis—a further frontier of scientific knowledge, implying yet higher productivities.



Now, why should the economic policy maker ever desire a nonzero unemployment level? The answer springs from the trade-off between unemployment and inflation—a trade-off often referred to as the Phillips curve (see page 52). In the American economy there is an empirical relationship between unemployment and inflation. It is not a functional relationship in the sense that unemployment causes inflation or that inflation causes unemployment; it is due to the fact that some of the factors affecting unemployment also affect inflation.

Thus, demand in excess of the economy's capability of production leads to low unemployment; but it also leads to inflation. In addition, the power of monopolistic and oligopolistic elements in the economy depends on the level of resources-utilization: if men and machines are fully utilized, the oligopolist is less worried by potential or actual competitors, since they can find no unused men or machinery. He can raise his customers' prices without worrying about the possibility that some other operator will be able to win them over.

So the policy maker is basically confronted with the fact that he must choose his targets out of a feasible set of alternatives, the limits of which lie along the Phillips curve. Exactly where on this curve he chooses his target will depend upon his analysis of the costs and benefits of inflation and of the costs and benefits of unemployment. This desired position—the maximum employment that he can obtain given the amount of inflation he is willing to tolerate—is often referred to as "full" employment.

The Nixon administration has been careful not to indi-

cate precisely its desired unemployment and inflation targets because of the political risks to anyone who openly advocates higher unemployment, but it seems to be aiming for an unemployment rate of something like 5½ per cent—in the belief that this will bring price inflation to a halt—followed by a gradual return to the neighborhood of 4 per cent to 4½ per cent unemployment as a minimum, hopefully without rekindling inflation.

### A Demand for Novelty?

If full employment is defined as desired unemployment, the economy will be at full employment if the Nixon administration can bring the unemployment rate near 5½ per cent in 1971. If it is defined as the maximum employment practicable, without regard to the rate of inflation—roughly what the man on the street means by full employment—this means an unemployment rate in the neighborhood of 3 per cent. For our present purposes, we shall use the term in the latter sense. Thus, if the Nixon aims are fulfilled, 1971 will be a year of underemployment. In that case, as we have seen, research and technical progress (in common with other factors) could have an impact on the growth of the economy only if they had an impact on aggregate demand. Increases in productivity can make no great difference.

For our purposes here, aggregate demand is best broken into seven categories: consumption expenditures, residential investment, investment in plant and equipment, state and local government expenditures, federal expenditures, inventories, and exports (see page 51). The latter two may be neglected—together they constitute less than 1 per cent of aggregate demand.



new-product or expansion facilities rather than simply on replacing the existing capital capacity.

Residential investment theoretically might be stimulated by new designs, but in practice residential investment expenditures have practically nothing to do with research and technical progress. They are dominated by demographic factors, monetary conditions, and personal incomes. Like other goods, technically better homes may yield more satisfactions but this will not show up on any economic indicators.

State and local government expenditures are also relatively easy to predict on the basis of well known causal factors. With a growing population, increasing concentration in large metropolitan areas, and with higher real incomes, America demands more and more public goods just as it demands more and more private consumption goods. Basically, research and technical progress do not influence the level of state and local spending.

Civilian federal expenditures depend upon the same set of factors that determine state and local expenditures. Our demand for federal civilian expenditures is determined by demography, geographic concentrations, and real incomes. Research and technical progress play only a small role.

Federal expenditures, however, also depend on two other sets of influences. First, federal expenditures on military hardware do depend on research and technical progress—weapons are made obsolete by research and technical progress, either here or in other countries, and as a result weapons are scrapped from obsolescence long before they would need to be scrapped due to old age. The result is higher federal expenditures on national defense.

The second influence on federal expenditures is one we have already mentioned: the adjustment of the different types of demand so that they add up to that total aggregate demand that will produce the policy maker's desired unemployment rate. This is done by raising or lowering taxes, transfer payments, grants-in-aid, or federal expenditures, and adjusting monetary policies. This mechanism clearly works independently of technical progress.

Thus, except for national defense and investment, it is not possible to uphold the argument that research and technical progress have any great impact on the economy's demand for goods and services. More importantly, however, such increases in demand are not necessary to run the economy, since the federal government has other instruments (fiscal and monetary policies) for raising or lowering the economy's demand for goods and services.

Consequently, the search for the economic role of research and technical progress must shift to the economy's supply capabilities—with the reminder that the magnitude of these supply capabilities is irrelevant unless demand rises to saturate them. Merely investing in new supply capabilities will make no difference to the

Personal consumption expenditures constitute the major ingredient in aggregate demand and, as such, their determinants have been extensively investigated. Theoretically, it is easy to imagine a world where research and technical progress could have a large impact on personal consumption expenditures. The idea is that demands for old products quickly become satiated, and the consumer spends his money only as new products are developed as the result of research and technical progress.

Such a consumer is not the American consumer or any other known consumer. To the best of my knowledge no economist believes that the magnitude of consumption expenditures depends on the existence of new or better goods to consume. The consumer may actually spend his money on a new product, but when he does so he simply reduces his expenditures on some old product. If the new product did not exist, he would simply buy the old product.

Investment expenditures differ from consumption expenditures in that they are not desired in their own right. They are a means to obtaining more personal consumption expenditures. Now, while new and better products resulting from technical progress require investment expenditures in order to produce them, individuals or groups must save more and consume less, in order to equip themselves with the new investment necessary to produce new goods or services. In effect, they throw away the old factories that produced the old goods. The result is a once-and-for-all increase in demand. To the extent that technical progress takes the form of new techniques that displace labor, investment in technical progress may actually reduce aggregate demands by causing unemployment and lowering incomes.

Research and technical progress are not the only outlets for investment—there are also the need to replace machines and plants that have worn out, and the need to expand production capabilities to meet expanding demands for (more of the same) goods and services. The latter—the investment necessary to service an expanding economy—is relatively easy to isolate; but it is difficult in practice to distinguish replacement investment from investment in new products or services. Corporate depreciation allowances, we know, amount to \$50 billion, but some of these allowances are spent on



The "demand" side of the economy can be broken down into the categories shown here. In the text, each category is examined for a possible link between technical change and the stimulation of demand.

### Elements of Aggregate Demand, Second Quarter, 1970

	Billions of dollars	Per cent
Gross national product	\$971.1	100.0
Personal consumption expenditures	614.4	63.3
Plant and equipment investment	102.8	10.6
Residential structures	28.4	2.9
Inventories	3.1	0.3
Net exports	4.1	0.4
Federal purchases*	99.7	10.3
National defense	76.8	7.9
Other	22.9	2.4
State and local*	118.7	12.2

\* Government purchases are smaller than government budgets because government budgets contain \$77.9 billion in transfer payments to persons.

economy unless the extra supply capacity is going to be used.

### Why Does Growth Happen?

We have a consumption economy, in which investment goods are merely a means to the end of more public or private consumption goods and services, and the ultimate benefit of the economic system must come in the form of more or better consumption goods and services. Further, we do not attach a premium to increasing the number of people, so, for us, real economic growth must take the form of increasing real income per capita. By this we mean an increasing capability to purchase goods and services (in the form of private consumption goods, public consumption goods, higher quality goods, more leisure, or whatever).

Real G.N.P. per capita has risen 2.4 per cent per year in the postwar period, with a range from 7.4 per cent in 1950 to -3.1 per cent in 1954 (as with productivity, business cycles have a sharp impact on the per capita output, since output falls while populations increase).

What produced the observed 2.4 per cent per year increase?

The additional output can be traced to five sources (see page 52). Some of the observed increases in output are caused by increases in the quantity of labor employed in the economy—in the American economy, something on the order of 20 per cent of the observed increases in output can be traced to a larger labor force. In addition, however, labor acquires new skills and improves its production capabilities. This is sometimes called labor-embodied technical progress. It accounts for something on the order of 34 per cent of the observed increase in output.

With investment, the amount of equipment increases, and this too contributes to growth in the production of goods and services. Increases in the quantity of plant and equipment account for approximately 3 per cent of the observed increase in output, while increases in the quality of plant and equipment account for 12 per cent. (The latter is called capital-embodied technical progress.)

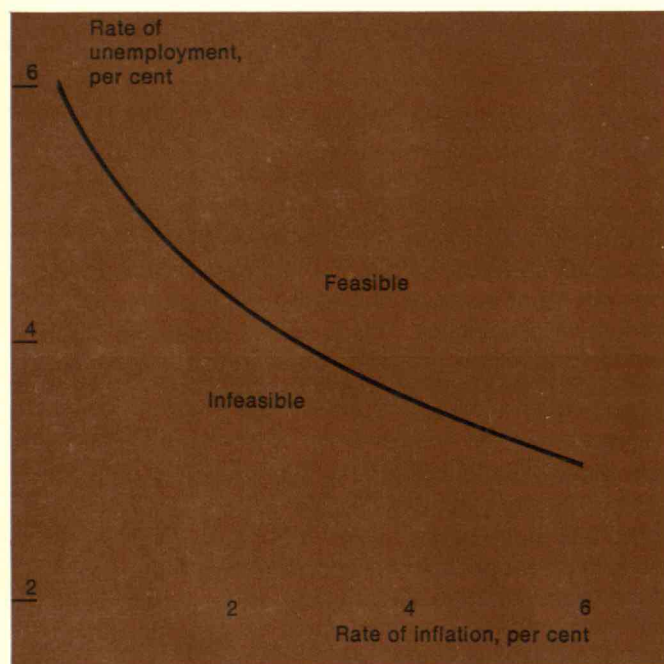
In addition, there is a source of economic growth that is labelled "disembodied technical progress." Whereas embodied technical progress requires changes in either men or machines, disembodied technical progress is a matter of improvements in the manner in which existing men and machines are used. Some of these improvements (11 per cent) come about because of economies of scale—with larger aggregations of men and equipment, each individual man or piece of equipment can work more efficiently. Some of them (1 per cent) come about because of improvements in the efficiency of our markets.

The remainder (20 per cent) has been assigned to general increases in knowledge. This estimate, however, is only a residual after other influences have been subtracted. This 20 per cent has been attributed to general increases in knowledge because no one could figure out what else it should be assigned to. In a real sense it is a measure of economic ignorance about the sources of economic growth.

In any case, only 23 per cent of total growth can be assigned to increases in the inputs of the classical factors of production. The remaining 77 per cent of observed



Unemployment and inflation are governed by a number of factors which are common to both; the result is that a given rate of unemployment implies a minimum feasible rate of inflation, and vice versa—a relationship described by the famous Phillips Curve (below).



growth must be due to some form of technical progress, therefore.

So the rate of growth of productivity and output depends upon: how fast the labor force is growing; the growth of labor-embodied technical progress; the growth of the capital stock; the growth of capital-embodied technical progress; and the growth of disembodied technical progress. Since the rate of growth of the capital stock depends upon the level of utilization of the economy, output will grow at different rates depending upon the utilization level at which the economy is operated. In the 1970's, with a 3 to 4 per cent unemployment rate, the rate of growth of productivity per man-hour will be approximately 3.2 per cent. This contrasts with an actual postwar rate of 2.9 per cent when the public sector is included. Since the labor force will grow at about 1.5 per cent per year, the economy needs to grow at approximately 4.7 per cent to maintain full employment. Thus, on the supply side of the economy, technical progress will account for 3.2 percentage points out of a 4.7 per cent economic growth. Technical progress is all-pervasive. It is the basic ingredient that makes economic growth possible.

But as to research: while it may seem almost axiomatic

The sources of economic growth are to be found in contributions from the basic economic factors of labor, capital, and technique, and these categories can then be further subdivided. The contributions are in most cases known (these figures are for the years 1929-1957); there is one exception—the 20 per cent assigned to "increases in knowledge," which is a remainder when the known factors have been accounted for.

	Per cent of total capital growth
Growth of the labor stock	54%
Quantity increase	20%
Quality increase	34
Growth of the capital stock	15%
Quantity increase	3%
Quality increase	12
Disembodied technical progress	32%
Economies of scale	11%
Increases in knowledge	20
Increases in market efficiency	1

that more research and development activities should lead to more technical progress, it is difficult to postulate this axiom on the basis of American history since 1940. More research expenditures do not seem to lead to more technical progress. The question remains, why not? The answer is unknown.

Lester C. Thurow, Professor of Economics and Management at M.I.T., is also on the Faculty of Public Administration at Harvard, where he is a Research Associate in the Kennedy School of Government. He edits the Kennedy School of Public Administration's Public Policy, and formerly edited The Quarterly Journal of Economics; and his books include The Economics of Poverty and Discrimination, for which he received Harvard's David A. Wells Prize.



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# Trend of Affairs

## The High Cost of High Technology

"There is no evidence that management controls will . . . have had any effect whatsoever in improving cost performance in the 1970's," said Robert Perry, Director of System Acquisition Studies at RAND Corporation. He was reporting, at the 1970 annual meeting of the American Association for the Advancement of Science, on a recent RAND study of one of the biggest problems of government spending—cost overruns on large-scale weapons systems.

The study compared contracts for total projects managed by the Department of Defense in the 1950's (32 projects studied) and a sample of comparable projects of the 1960's (15 studied). The aim was to answer the question, "What was the true extent of project growth?"

Dr. Perry showed that during the 1960's the average cost growth, from first estimate to final total, was 40 per cent. Schedules slipped an average of 15 per cent, and the final product performed sometimes twice as well, sometimes half as well, as the original performance specifications required.

And in the 1950's—even though estimating methods were far cruder and D.O.D. planners were without such management "tools" as P.E.R.T. diagrams, which were used in the 1960's—the data came out much the same.

As to the future, Dr. Perry's projections offer little hope to the cost-conscious taxpayer. In the 1970's, he said, "future cost uncertainty will be fairly large," with technical uncertainties accounting for one-third of the rise in cost from project beginning to end, scope changes accounting for half the increase, and cost and estimating error hovering around the 15 to 18 per cent mark—where it has been for the last decade.

Private industry in the 1960's performed much better than D.O.D. in managing large-scale projects, he said. In aircraft construction, for example, the industry's cost growth on civilian projects averaged only 10 per cent; schedules slipped 2 per cent; and performance goals were met regularly.

Most European nations also do much better than the D.O.D. in managing large-scale weapons construction. Dr. Perry cited figures showing that France, West Germany, and Britain are likely to use fewer government personnel for overseeing projects (the F-111 utilized 4,000 government personnel in this fashion, the British counterpart, 75). The Europeans pay 50 to 75 per cent less overruns to reach the "prototypical" stage on comparable projects. Not until this stage is completed is a decision made on the number of items finally to be built—and a separate contracting procedure is then invoked. Such separation of development and production, said Mr. Perry, is an additional control. Finally, there seem to be tighter controls during production, with very few additional technical changes.

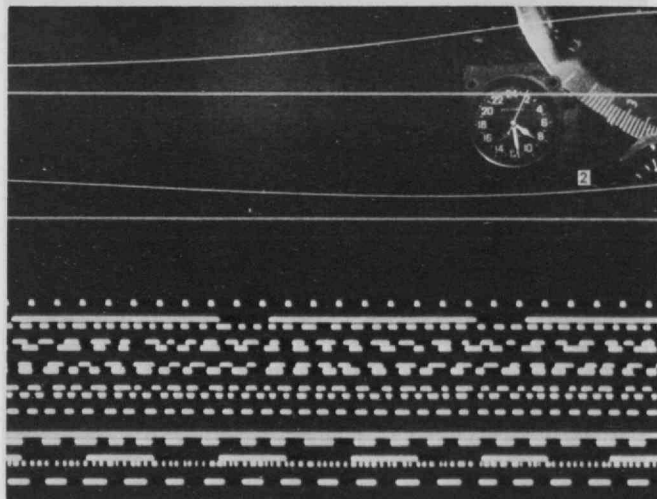
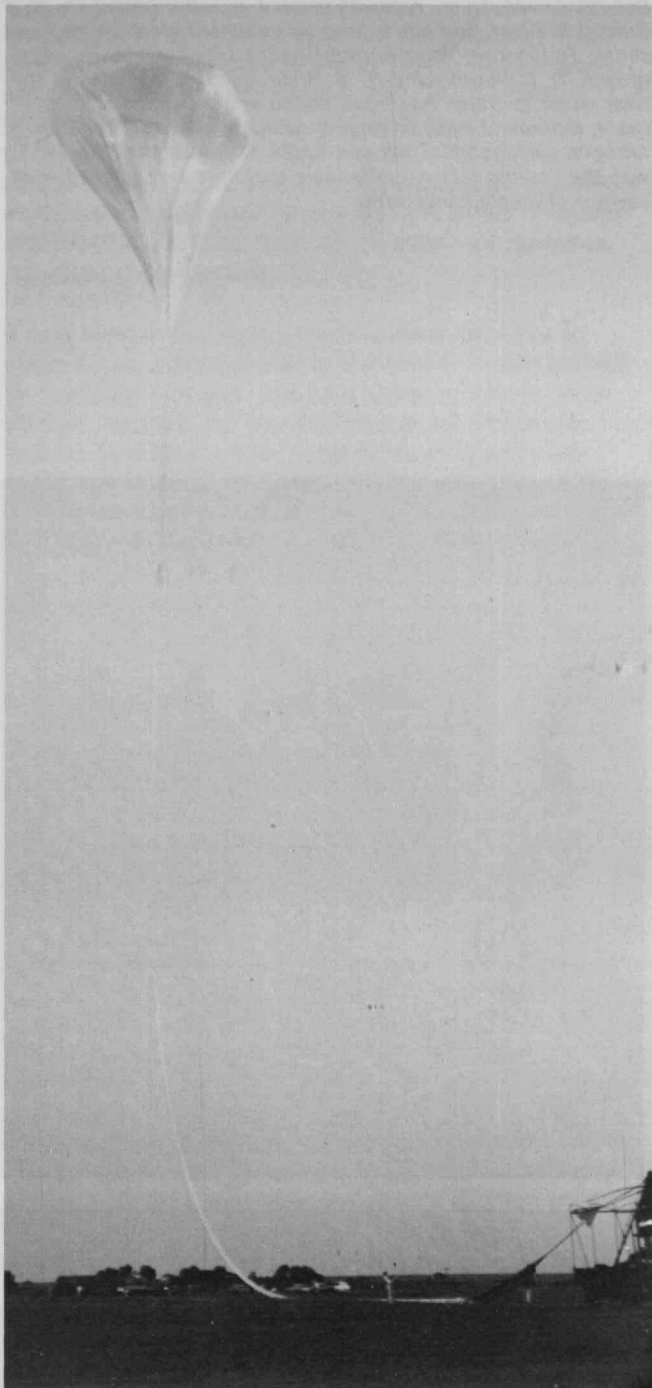
The British-French Concorde is a well-known exception to this picture of European cost control. What are the prospects for the American S.S.T.?

Mr. Perry referred to one of his charts: a scale from one to 20 on which a project can be rated according to the extent to which it represents an advance over the known technical knowledge or state of the art. All the systems RAND studied—the Pershing missile, the C-5A, the Titan C-3, and the Minuteman, among others—have been given ratings, and Dr. Perry found a correlation between the "technology" rating and the accuracy of the original cost estimate. Projects rated from one to eight, he said (representing little advance in the state of the art) have very predictable costs. Systems rated between eight and 12 on the scale are "somewhat" predictable. A rating of 16 or more on the scale means the initial cost estimates are "worthless." On this scale, Dr. Perry said, the S.S.T. hovers between 18 and 19.

## The Romantic Science

Two successful flights, one with the largest balloon ever used for X-ray astronomy, have been reported by an M.I.T. team under the leadership of Walter H. G. Lewin, Associate Professor of Physics.

On October 16, 1970, instruments were flown at 148,000 ft. above the Australian continent for a period of 10 hours—long enough to give the M.I.T. group hope of obtaining detailed information on the positions of high-energy X-ray sources, on energy spectra, and on possi-



*The largest balloon (34 million cubic feet) ever flown for X-ray astronomy about to be released from Mildura, Australia, on October 16, 1970. Professor Walter H. G. Lewin's M.I.T. group will make one more Australian expedition to fly balloons in February, 1972, and then will concentrate on experiments to be carried aloft by satellites for periods of observation far above the earth's atmosphere. But, says Professor Lewin, the romance will be gone.*

*Balloon-borne X-ray observatories designed and flown by the M.I.T. Center for Space Research show (the wavy top lines) the changing directions in which the equipment was pointed and (the level pulses) the number of cosmic X rays of different intensities recorded in each 10-second period. It is thus possible to determine the direction, energy, and timing of the cosmic X rays received—and hence to identify X-ray sources and to study variations in the intensity of their radiation.*

ble short-term time variations in the X-ray emissions. In addition there is the possibility that sources never seen before have been recorded.

The ultimate goal of course, is to resolve the mystery of how there can be sources of such tremendous amounts of high-energy radiation in the galaxy and how they relate to the more familiar astrophysics and astronomy of visible and radio objects.

The 1970 balloon flights were the latest in a series of M.I.T. experiments on cosmic X rays which first attracted major attention in 1968, when Professor Lewin, George W. Clark, and W. B. Smith reported the first observation of an X-ray flare from the oldest known X-ray source, Sco X-1. This X-ray source was identified in 1966 by scientists from American Science and Engineering and M.I.T. as an erratically varying blue star.

Most X-ray sources in the sky appear near the galactic center, which can best be observed from the southern sky—hence the choice of Australia for the balloon flights. The mysterious cosmic X rays are completely absorbed high in the earth's atmosphere—hence the necessity to carry equipment to extreme heights by balloons, rockets, and satellites.

The M.I.T. group still has the intriguing possibility of finding significant results, long feared lost, from an April 16, 1969, balloon flight in Australia.

Devices designed to separate M.I.T.'s X-ray telescope from its balloon failed to operate on radio command, and the instruments that finally parachuted down into Tasman Sea were given up for lost. But nearly a year later, in March, 1970, part of the equipment caused a minor mystery when washed up on a New Zealand beach. Recovered and returned to Cambridge, the instrument package yielded photographic film which is legible—though it cannot be processed by the automatic equipment which has been designed to read the balloon-flight data. Instead, one of Professor Lewin's students, Stanley G. Ryckman, has now begun the laborious process of analyzing a 30-foot section of the film of which 300 feet were salvaged. This section of the film is devoted to X-ray observations of Sco X-1, whose visible light intensity was simultaneously monitored by Australian astronomers. The analysis may reveal a correlation between variations in the X-ray flux from Sco X-1 and fluctuations in its visible light intensity.



# Lake Cleaning . . .

Among those concerned with restoring "eutrophicated" lakes to something like their former condition, the case of Lake Washington has aroused some interest, since it represents a limited but real success. Lake Washington lies on the inland side of Seattle, Wash., which is bounded on the west by Puget Sound and which, historically, has disposed of its growing output of sewage into either the one or the other.

By 1954 there were ten two-stage biological treatment plants around the lake, and the amounts of algae and nutrients in the lake were increasing, accompanied by a diminution in deep-water oxygen concentration in summer. In the following year there was a sudden growth of the alga *Oscillatoria rubescens*, which many regard, on the basis of European experience, as a harbinger of worse things to come.

Professor W. T. Edmondson, a University of Washington zoologist, speaking at the annual meeting of the American Association for the Advancement of Science, told how a governmental organization called Metro was set up to deal with the lake's deterioration. "The success of the campaign to form Metro depended upon a great deal of work by citizens' groups. Pro and con viewpoints were presented in many public debates. This free exposure of information and opinion made it possible for the voting public to develop a reasonably good knowledge of the issues."

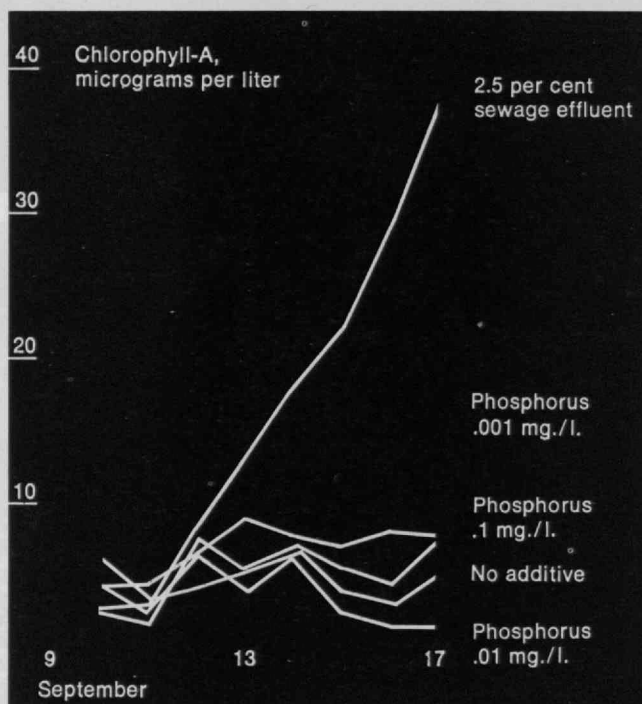
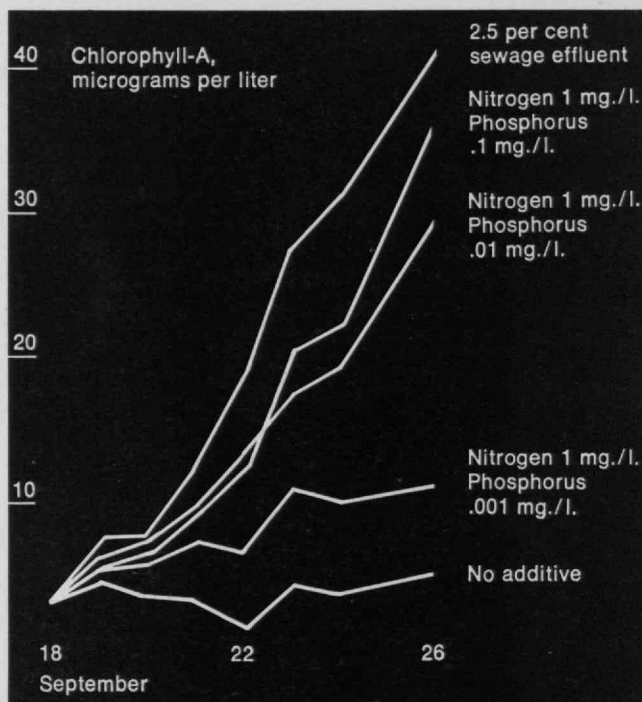
"After a certain amount of difficulty," Dr. Edmondson recalled, "Metro was passed on the second vote in 1958." It took until 1963 to get a sewage-diversion program started, which was concluded in 1968. So far the program has cost about \$145 million.

But once the sewage was diverted (into Puget Sound—a strategy that was fortunately possible) the process of eutrophication promptly began to reverse. "During late summer of 1969, the deep water oxygen conditions were more favorable than in 1933, phosphate was nearly down to the concentration of 1950, and the summer transparency was two and a half times as great as in 1963."

Lake Washington is a small lake—about 15 miles by three—which had not deteriorated very far, and there was a convenient alternative body of water. This switch from the lake to the Sound was not unprecedented. In the early 1930's the same strategy provided temporary relief, at a time when Seattle's sewage was discharged untreated. Biological two-stage treatment was the next stage, introduced in 1941, but the Seattle urban area continued to grow, with the results described above.

A more general solution is further treatment, to remove from the sewage the plant nutrients which stimulate algal growth. Charles F. Powers and Robert M. Brice, who work for the National Eutrophication Research Program (N.E.R.P.) at the Pacific Northwest Water Laboratory, Corvallis, Ore., commented that Seattle-

Shagawa Lake, Minn., receives most of its water from Burnside River, and has a sewage-treatment plant on its shore. To discover ways of reducing the lake's excessive algal growth, C. F. Powers and R. M. Brice observed samples of the river water to which had been added either sewage effluent (as in the actual lake) or varying amounts of phosphorus or nitrogen compounds. Their conclusion was that phosphorus was the limiting factor, and should therefore be removed from sewage effluents henceforth.



type diversion "does not necessarily constitute a final answer," and went on to describe the Shagawa Lake Eutrophication Research Project. Shagawa is a four-square-mile lake in Minnesota, with "a long history of nuisance algal blooms" attributable to the town of Ely's sewage-treatment plant. It thus presents a simple experimental situation. The object of the recent studies there has been to discover the effect of removing specific nutrients from the sewage—phosphorus, nitrogen, or carbonates.

It now seems that algal growth is most sensitive to phosphorus, although part of the time it is also limited by available nitrogen. The next phase will be a cooperative program by the Environmental Protection Agency (a branch of the Federal Water Quality Administration, responsible for N.E.R.P.), the city of Ely, and other concerned agencies. The program will set up a full-scale advanced treatment facility "with emphasis on phosphorus removal from all of Ely's sewage system."

## ... And the Size of It

Success with small lakes does not imply success with big ones, even given comparable stages of deterioration. Professor C. H. Mortimer, F. R. S., Director of the Center for Great Lakes Studies at the University of Wisconsin, Milwaukee, made it clear that in some respects a Great Lake is a quite different kind of thing from a small one—notably in respect of water circulation. "Recent research in the Great Lakes is providing increasing evidence of quite large differences, in water chemistry and in biological properties, between inshore and offshore waters. These differences," said Dr. Mortimer, "must be attributed to a scale effect associated with the large mixing distance between inshore and offshore waters and with the fact that, in basins of Great Lakes size, the earth's rotation plays a dominant role." These and other, seasonal, effects result in shoreline currents, whose practical effect is that effluents tend to stay near the periphery of the lake rather than being diluted in its whole body as they are in a small lake.

Eutrophication control in the Great Lakes, said Dr. Mortimer, will depend on the control not only of point sources such as sewage treatment plants but also of the diffuse sources arising from land use practices in the whole drainage basin. It may necessitate treating whole rivers, "on a scale not yet contemplated and at a cost not yet assessed."

So an understanding of the large-scale behavior patterns peculiar to the Great Lakes becomes essential, "otherwise we may be expensively misled," Dr. Mortimer warned the American Association for the Advancement of Science.

## Gentler Influences

Let the polluters do what they will—only make it unusually attractive to do what you would have them do. In other words, tax them for their discharges—this is the economist's choice, according to several economists who discussed at the A.A.A.S. meeting the economics of pollution and various strategies for controlling it. Their reason: a difference exists, perhaps one not so subtle, between being ordered to take a certain action and choosing it because it is the best, most economical, alternative you have. The results are the same; the process is not.

To induce good behavior somehow allows responsibility to fall on us all; to demand it places it in the care of "the government," as Edwin Mills, professor of economics at Princeton, pointed out. Letting "the government" do it slides into letting the government decide—what we want and what is good for us. He prefers the freer choice.

Even the administration of a fee-for-fouling scheme works for decentralization, said Dr. Robert Solow, an economist from M.I.T. A flat system of fees, once established, needs little interpretation by administering officials. The bureaucratic component is lessened. By contrast, Dr. Mills added, the administration's new program to regulate pollution requires that a license to discharge be obtained. He feels this will be an "awkward and cumbersome" business, entailing a "very long series of elaborate bureaucratic procedures."

Another suggestion has been to subsidize manufacturers for building pollution control plants. This drew Dr. Solow's disapproval—one might be tempted to increase one's discharges just to gain a higher subsidy. (If we are to be persuaded by a system, let us be persuaded to do good.)

Besides, the economists added, taxes put money into the treasury.

## Kind to Your Hands?

In 1968, five employees of the University of Colorado Medical Center reported that their hands had become depigmented, and were referred to Dr. Guinter Kahn, of the Center's Division of Dermatology. All five had developed this color-change at the same time, after a new cleaning solution was introduced. All had followed the directions for its use, avoiding direct contact with the skin.

The culprit proved to be para-tertiary butylphenol (ptBP), a 6 per cent solution of which produced depigmentation in volunteer test-subjects. Following a similar development in a neighboring hospital, para-tertiary amylphenol (ptAP) was found to have the same effect: depigmentation begins to show after about six months of use. (Clinical tests use a technique which gives much faster results.)



*Dr. Robert S. Lees and Dr. C. Forbes Dewey, both of M.I.T., with the sound spectrograph used in phonoangiography, the analysis of arterial sounds produced by fat deposits in the blood vessels. Using known fluid mechanical principles, diagnosis can be made quickly and inexpensively, without having to go inside the patient's body.*



Later—Dr. Kahn told a session of the American Association for the Advancement of Science—these findings were confirmed at many hospitals, and it was discovered that Russian investigators had reported similar effects of ptBP in 1966. What seems to happen with a “one-step” cleaning and disinfecting agent containing ptAP or ptBP plus a detergent is that the latter helps the damaging phenol to penetrate the skin.

Dr. Kahn raised the obvious question of why the manufacturers had not discovered the effect before selling the mixture. “I believe,” he said, “the answer lies in their short-term testing measures.” The common method of testing for side effects “consists of immersing the extremities into a tenfold-anticipated-use concentration of the phenolic detergent and its components for a variable amount of time,” observing the skin daily for one week. What happens in six months is left in the hands of the cleaner.

## Phonoangiography

By combining precision and indirection, two M.I.T. researchers have devised a way to diagnose the location and extent of atherosclerosis (hardening of the arteries) without going inside the body. Dr. Robert S. Lees, Director of M.I.T.'s Clinical Research Center, and Dr. C. Forbes Dewey, Jr., Professor of Mechanical Engineering, call their new technique phonoangiography, “the quantitative analysis of sounds produced by blood flow.”

Atherosclerosis is responsible for nearly half of all deaths in the U.S. each year. Fatty substances in the blood adhere to arterial walls, and blood flow at the site of buildup becomes increasingly constricted. (If occlusion becomes complete, the victim suffers a heart attack.)

Arteries are normally silent, but blockage of the vessel produces turbulence in the blood flow immediately downstream of the obstruction. Such turbulence causes pressure-variations at blood vessel walls, and this variable pressure creates acoustic waves which radiate through surrounding tissues. These waves are detectable with a stethoscope or, in this case, a microphone at the body surface.

First, a piezoelectric displacement transducer, hand held over the obstructed artery, is moved about to find the location of maximum sound intensity. The signals are then recorded on tape, rerecorded on a sound frequency analyzer, and scanned with a narrow-band frequency filter.

Working from fluid mechanical theory of turbulence in rigid pipes, Professor Dewey has developed a method for estimating the extent of arterial narrowing using only two variables: the actual diameter of the artery, obtained from analysis of sound spectra, and the normal unoccluded vessel diameter. Phonoangiography appears simple, inexpensive, and feasible in either hospital or office, whereas catheter angiography (the direct measurement of the arteries by insertion of a tube in the blood vessel) is expensive, extremely uncomfortable, and risks infection, bleeding, and arrhythmia (irregular heartbeat).

As yet, however, the technique is still rudimentary. For example, as an artery becomes more and more closed off, sound intensity diminishes rapidly until, in a completely occluded vessel, there is no sound at all.

Second, researchers are interested in studying deeper blood vessels, especially the coronary arteries which supply the heart with blood and whose occlusion leads to myocardial infarction, the most common form of fatal heart attack. It is hoped that greater sensitivity in pickup, recording, and analysis will mitigate the absorption and multiple reflection of sound by tissues, which now make such deep-level study impractical. It may also be possible to filter out most cardiac sounds and, for the first time, listen directly to the arteries themselves.

## By the People

The absence of a national policy for publicly funded research was of course the subject of much concern at the annual meeting of the American Association for the Advancement of Science. In an all-day session on “Goals Analysis—Looking Ahead to 1980” a somewhat unusual proposal came from an Arthur D. Little senior economist, George Gols: ask the public to express their preferences as to the ends to which their research expenditures should be devoted.

The idea is that people could vote on, for instance, "whether they prefer  $x$  per cent over  $x + 1$  or over  $x - 1$  per cent to be spent on basic science research; we could also ask them to rank for us their science research preferences, and react to proposals such as the following:

"(1) Every major city in the United States with a population over 150,000 should have a computerized diagnostic health center capable of mass-screening our citizenry at modest costs;

"(2) Every city of such a size should have a pollution-free incinerator capable of disposing of all the solid wastes generated by households and businesses in the area; . . ."

and so on, for education, welfare, recreation, and transport. Scientific and technical expertise would be required in delineating the real choices, but the public would do the choosing.

Admitting that the specific examples here were "somewhat utopian and yet inadequate," Gols nevertheless submitted that "it is not so unreasonable a means to determining priorities as one might think."

## For Technological Renewal

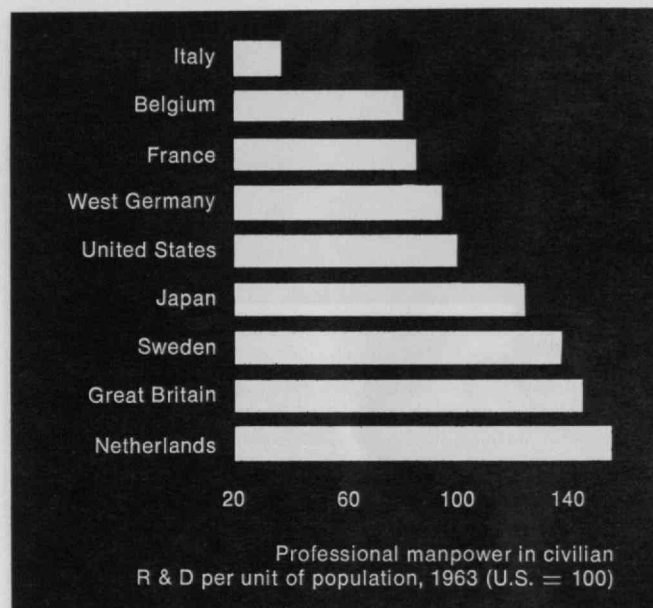
In the past three decades, the U.S.—having shared the content of its technology through foreign aid with both industrialized and underdeveloped nations of the world—has maintained its economic power, seemingly, through superior management.

But now our time is running out. "Unless we apply superior technology, not just equivalent technology, we shall not be able to compete without a material reduction in our wages," Myron Tribus, Senior Vice-President for Research and Engineering at Xerox Corp., told the annual meeting of the American Society of Mechanical Engineers late last fall. "Technology makes the difference between profit and loss," he said.

In 1957-63, said Dr. Tribus, citing unpublished figures assembled by the Department of Commerce, U.S. firms competing in the British market—and in all "advanced" countries—returned up to twice as much on sales as did U.K.-financed firms in the same markets.

Meanwhile, by 1963 the civilian research and development effort per unit of population was higher in Britain, the Netherlands, Sweden, and Japan than in the U.S. Since then other nations have gained while the U.S. has declined. "We are a long way from reaching our ultimate potential in developing and applying new technology for greater productivity," he declared. Our predicament is made more difficult by two particular circumstances: with "rare exceptions" U.S. leadership "in both the executive and legislative branches doesn't have the foggiest notion of how to deal with technology." And technological indices play no real role in economists' models of national economics; "there are at present no provisions for investments in research and develop-

ment—as Myron Tribus, Senior Vice-President for Research and Engineering at Xerox Corp., contends—"the employment of technical personnel in research and development is an indicator of how well a society will do in technology in the future," then the outlook for the U.S. may not be so rosy. The data below were assembled by M. Boretsky of the U.S. Department of Commerce as of 1963; since then, Dr. Tribus told the A.S.M.E. late last fall, all nations except the U.S. "have shown an increase in technical effort."



ment as indicators of the future economic well-being" of a nation. We thus have a false sense of security, arising from "the assumption that the country will be saved by analysis rather than creativity."

To pull the nation off its dead center, Dr. Tribus proposed an "emergency measure": for the next five years, give a special tax credit to industries whose research and development budgets for manufacturing processes are increased to 5 per cent of sales. It would be the first step, he said, towards "a new era of American technological renewal."

## Car of the Future?

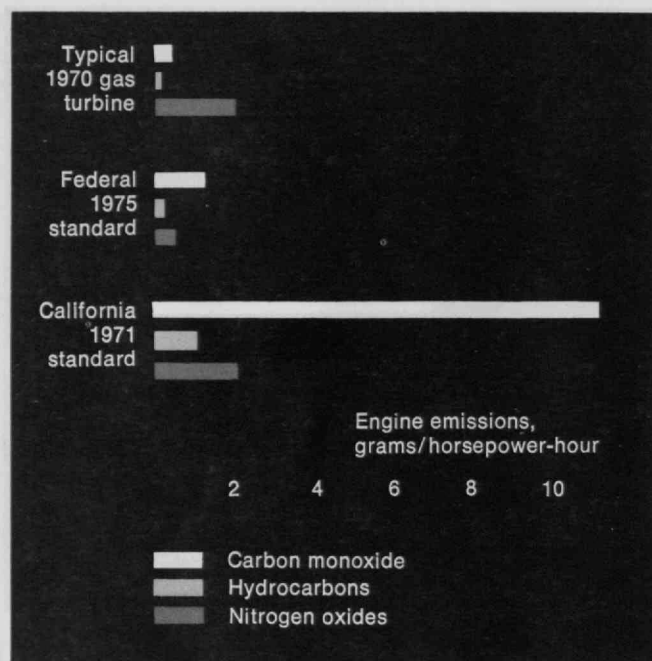
If you are willing to spend \$75,000 for your next automobile, you can in eight months have a gas-turbine-powered car in your garage. It will perform as well as any car you've been driving; its luggage space will be smaller, because its fuel capacity must be larger; but it will be dependable, and its exhaust will be almost completely clean.

Would you be buying the car of the future?

The answer is by no means clear. Advocates of the gas



Given moderately ideal operating conditions, today's gas turbine engine produces far fewer air pollutants than the conventional internal-combustion engine. But improvements—particularly in nitrogen oxide emission—depend on successful research and development which is now only beginning; and reducing nitrogen oxide emission may not be possible without higher emission of other pollutants.



turbine are optimistic: already it meets all air pollution criteria for hydrocarbons and carbon monoxide which have ever been proposed for the U.S. Its higher emissions of nitrogen oxides can probably be controlled, though the method of doing so is not yet certain.

"If all present internal-combustion automobile engines were replaced by gas turbines, the motor vehicle contribution to total air pollution would be reduced from 60 to 2 per cent," Edward S. Wright of United Aircraft told the annual meeting of the American Society of Mechanical Engineers this winter.

"But it won't fly," was Arthur F. Underwood's reply. Mr. Underwood, formerly—before his retirement—Manager of General Motors' Research Laboratories, was serious: automotive service is very different from aircraft service, where gas turbines have proved their effectiveness. Automobiles operate at full power or speed for only very small parts of the service cycle, and gas turbines adapted for use over a wide range of loads and speeds will be expensive and inefficient. In any event, their fuel consumption is high, their fuel not markedly less expensive than conventional gasoline.

William P. Lear of Lear Motors Corp. disagreed. Many

gas turbine parts need not be so precisely made as parts for conventional automobile engines, he said; and new ceramics may replace metals in many of those that do. Development work remains, but "the tremendous potential demonstrated by prototype hardware virtually assures major cost reductions and improved performance for future gas turbines," he told A.S.M.E. members.

Is there room for compromise between these conflicting views of technology? Homer J. Wood, a West Coast mechanical engineering consultant, told A.S.M.E. that there is simply too much work still to be done; no engineer can predict its outcome yet. "Significant cost reductions are in sight with exploitation of new materials, manufacturing methods, and flow path technology. A case can be made for future gas turbine manufacture at competitive costs, but no consensus exists as to details of such a power plant," Mr. Wood declared.

## A Steam Car for Today

If the gas turbine is controversial and uncertain (see above), what about the steam engine as a non-polluting automotive power plant?

Paul T. Vickers of General Motors' Research Laboratories answers, no—at least given present standards of automotive convenience. His (perhaps biased) judgment is based—at least in part—on experience with two steam cars built and tested by General Motors within the past three years.

Mr. Vickers admits that a steam engine can be made almost completely nonpolluting. His criticism is that today's steam car simply has to meet some design criteria which its predecessors by 40 years did not try to reach. Today's car, for example, cannot depend on making frequent stops to replenish boiler water. ("The steam engine met its demise when horse troughs were banned as carriers of foot-and-mouth disease," he told the A.S.M.E.'s 1970 annual meeting early this winter.) It must have enough surplus power to run such accessories as air conditioners and power steering. And it must be so easy to start that every housewife can take it on the day's round of errands. Given these requirements, a steam car looks like a poor runner.

To test its ideas General Motors converted a Pontiac Grand Prix to steam propulsion two years ago. To make it miserly of water, the Grand Prix had to have a condenser far larger and more expensive than the automobile radiator it replaced. Indeed, the engine compartment had to be increased by 7 inches, and the wheel base by 5 inches, to accommodate the extra machinery.

To make start-up time short the water inventory had to be minimized and the heat intensified; in the end the G.M. steam Pontiac generated enough heat to warm

20 homes in Detroit on a typical December day. Yet the car was not ready to drive until more than two minutes after the ignition was turned on, and by then it had used one-fourth gallon of kerosene—even before it was ready to move out of the driveway. More than 150 electronic circuits were used to control water and heat circulation during the two-minute warm-up period.

## Hearts and Minds

On certain days, in South Vietnam's central highlands, the bewildered farmers see poison delivered by an evil spirit upon their crops. The inhabitants of another country, of course, know this to be no mystical being. The evil spirit is identified to us as a C-123 cargo plane; the poison is cacodylic acid or 2,4,5-T (see pp. 12-13).

The Montagnards, however, believe that all things are invested with spirits: they have a particular belief that an evil spirit is born of poison and is manifested in poison. That cacodylic acid bears and is an evil spirit fits naturally to their cosmology. The big bird dispenses its pestilence to manifest displeasure: displeasure that can be relieved not by political acquiescence but by animal sacrifice—or long passage of time. The Montagnards accept the pestilence. They are stoic. Once the land is wasted, they leave it.

Yet they are a sophisticated people. Dr. Matthew Meselson of the Herbicide Assessment Commission of the A.A.A.S. described them as like American Indians—on a side track to modern technology. They use the simpler tools, and small arms. They build hillside terraces to retain water; they have defined styles of architecture. Their social codes are well developed; they have established patterns of family life, of the holding of land, of cultural life. They are an intelligent people. No one, Vietnamese or American, has sought to explain to the Montagnards that the C-123 is a tool, as their plow is a tool. So this piece of modern technology fits better into their mythical explanations of the world than into their concepts of technology.

Their technology is of agriculture. They are sophisticated in their understanding of the forest ecology. They use the forest cycle to fertilize their crops, with no harm to the land or to the forest. They live within its system. The Montagnard method is a forest/fallow sort of crop rotation. They cut a section of forest and burn it. The trees decay, and the soil takes up their nutrients. Crops are planted for several years, until the topsoil is leached of value. Then the land lies fallow for ten or a dozen years, and the early stages of the forest begin to grow again. The Montagnards turn to other sections during this period, in a careful cycle. When the trees are partially regrown, and the nutrients pulled from the under-soil back above ground, the trees are again cut and burned, the nutrients returned to topsoil. It is, Dr. Meselson says, a use of the forest that is "marvelously planned and ecologically harmonious." It is conservative of trees and other living things—perhaps out of respect for the spirit that lives in each of them.

Perhaps 3,000 sq. km. in South Vietnam have been sprayed with herbicides, like this mangrove forest not far from Saigon. Though sprayed only once—to defoliate but not necessarily to kill—the trees in this area all died and none of the ground shrubs have grown back. In the highlands where hardwood forests have been extensively sprayed, economic loss is estimated at \$500 million, one-sixth of South Vietnam's 1967 G.N.P.



## A Lack of Data

In April, 1970, the Department of Defense ordered that the spraying of one of three herbicide mixtures, called "Orange," should be stopped, following the laboratory finding that one of its constituents (2,4,5-T) caused birth deformities in animals. Up until that time Orange had accounted for about 60 per cent of the spraying (what the percentage has been since the DOD order is unknown), but for killing crops in populated country another agent is usually preferred. The Herbicide Assessment Commission therefore attempted an "evaluation of the feasibility of demonstrating any change in the pattern of births in Vietnam which might have resulted from the exposure of some of the Vietnamese population to 2,4,5-T." Because of the inaccessibility of precise spraying records, and the inevitable patchiness of health records, the Commission's conclusions are primarily that no conclusions can be made, as yet, but that more profitable research is possible.

Records for the children's hospital in Saigon—the only large one in the country—show no increase in any particular congenital defect other than spina bifida (a malformation of the spine) and cleft palate. The



former increased quite suddenly from two or three cases a year to 13 in 1967 and 12 in 1968; the latter, from a similar background frequency to 12, 23, and 13 in '66, '67, and '68 respectively. Cleft palate was among the birth deformities found in the laboratory animals. Saigon, however, is not typical of the main defoliated areas. The mountain people, on the other hand (see above), have almost no place in the country's health records, so the effects upon them of the heavy spraying they have received cannot be statistically evaluated. Dr. John Constable, of Harvard Medical School, talked to Montagnard refugees and found that many of them believed that herbicides had indeed caused illness, especially in children and elders.

In conclusion, the Commission indicates desirable directions for future study. "With the aid of local Vietnamese authorities," they write, "and, it is to be hoped, with the complete spray data available from the U.S. Department of Defense, the Vietnamese population exposed to 2,4,5-T could be much more precisely identified and isolated and the individuals studied for possible effects of the agent." This would particularly include (echoing the laboratory observations) "very careful studies of gastrointestinal tract, urological tract, and biochemical changes of children born after exposure." The Commission also recommends inter-province comparison of stillbirth rates, as a follow-up to their discovery of evidence suggesting an abnormally high stillbirth rate in one province (Tay Ninh), large areas of which had been treated with 2,4,5-T.

## STARE, GROPE, and Other Capabilities

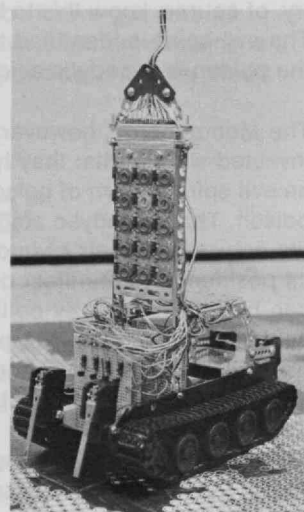
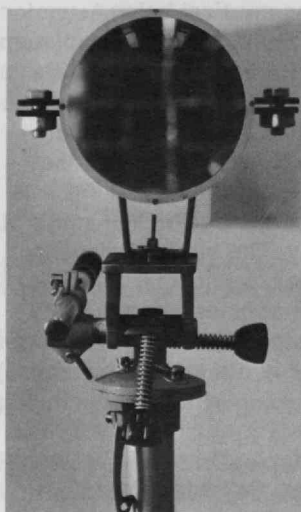
Professor Nicholas Negroponte, of M.I.T.'s School of Architecture and Planning, is interested in computer-aided design, but not in the usual sense. He would like his mechanical assistant not only to be able to perform mathematics operations, but to be able to comprehend to some extent the nature of the task in hand, and thus to be capable of recognizably intelligent behavior. As many philosophers have said, all knowledge comes through the senses. The photographs show two of a number of senses.

In an article recently published by the British journal *Architectural Design* (1970, No. 9, pp. 466-469), Professor Negroponte and his colleague Leon B. Groisser point out a vital difference between machines and people, as we know them: whereas it is easy to put a definition of, say, *corner* into the memory of the simplest computer, "the most complex machine cannot go from this context-independent, sensor-effector-independent definition to understand, for example, 'let's corner the troops' or 'go to the corner store.'" But a child can, having learned by extensive experience the range of ideas that are associated with *corner*.

The authors ask: "If we give our computers behavioral abilities similar to people's, will they by definition evolve into intelligent designers?" Cautiously, they answer in the double negative: if we don't, they won't; so try it.

*STARE is a kind of eye, designed and constructed by Andrew Lippman and Robert Freedman. It has a six-inch lens and 16 photocells, whose signals are separately converted to 8-bit digital form for storage.*

*GROPE, due to Steven Gregory, is a Japanese toy tank fitted with the same number of photocells. Two tactile GROPEs have now been built, one of which explores solid obstacles, the other, surface textures. These devices are part of an exploratory project aiming ultimately at allowing machines to arrive at their own view of the world.*



The Urban Systems Laboratory has sponsored within the School of Architecture an Architecture Machine Project, which has resulted in a number of sensors and actuators linked to a central computer. One of the more dramatic is SEEK, which constantly reconstructs a building-block city whose dwellers are a colony of gerbils with their own ideas of where things should be. SEEK was featured at the Jewish Museum of New York's "Software" exhibit in September, and then went on to the Smithsonian.

## The Same the Whole World Over? 70 %

At the M.I.T. Industrial Liaison Symposium on "The Multi-National Corporation," held in New York City this fall, Professor Mason Haire of M.I.T.'s Sloan School spoke of the national cultural differences that affect styles of management. Such differences are of enough practical importance to be worth knowing about before one ventures one's capital upon foreign soil.

Management styles can be researched. And yet we continue to rely on popular stereotypes and travellers' tales—or we forget the whole question, assuming that management is a science that knows no boundaries. Professor Haire quoted two studies: one, in which he was a co-worker, of 4,000 managers in 14 countries; the other, by I.B.M., of 12,000 of its own managers.

Of the stylistic differences between individual managers, about 30 per cent are associated with their nationalities. Such differences should therefore be taken into account in selecting managers to send to a particular country, in training them for their assignments, and in designing training courses for the locals. The vast range of success and failure among overseas operations, Professor Haire thought, could probably be attributed largely to these cultural effects.

The manager going abroad needs to understand the host country's prevailing view of "the path to salvation." (Is a successful person one conspicuous for self-denial, or consumption? Is he a self-made man, or an extension of his ancestors? Does he strenuously control his surroundings, or is he content with them much as they are?)

And it is not simply that each country has its own culture. One country may have many ways of life within it, each with its own goals and habits of mind. Conversely, a number of nations may have enough in common to constitute a cultural "cluster," like the Scandinavian countries. The one country that refuses to be classed with others stylistically is Japan, Professor Haire finds.

In this kind of research, national character is mapped out in perhaps 20 independent dimensions. A company about to enter a new country can find out the main relevant idiosyncracies for between \$20,000 and \$50,000, Professor Haire guessed.

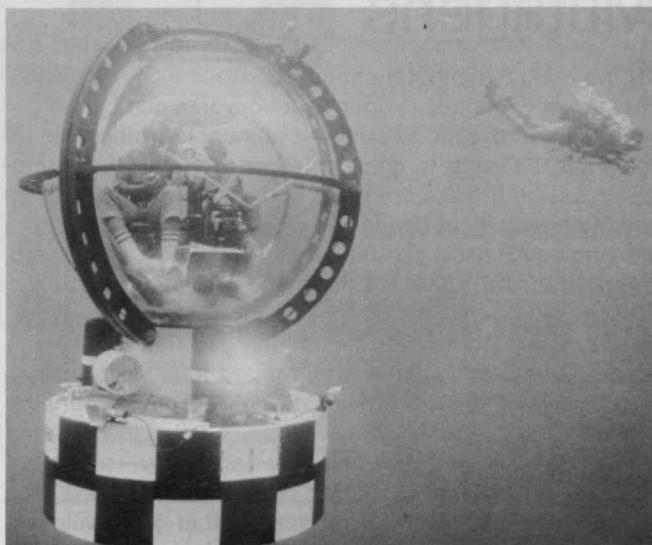
His final shot was aimed at American management skills in general. The easy success of the U.S. after World War II produced a false sense of security, and the notion that America had so much management talent that it could easily afford to export this intangible commodity. Today, he said, it is no longer clear that we have enough managing ability to go around at home.

## The Anti-Fishbowl

According to a Naval Oceanographic Office publication of 1968 (R. F. Busby's *Design and Operational Performance of Manned Submersibles*) the efficiency of underwater explorers rapidly deteriorates when they have to adopt a variety of unnatural positions to get to the viewports. The Naval Civil Engineering Laboratory (N.C.E.L.) and the Southwest Research Institute (S.W.I.) have therefore combined their talents to produce the vehicle shown in the photograph.

NEMO, as it is called (Naval Experimental Manned Observatory), consists of a 5.5-ft.-diameter acrylic sphere—developed by the Pacific Missile Range under contract to N.C.E.L.—plus life support systems for two men, a lead anchor, a winch, a pair of hydraulic motors for horizontal drive, a 5-h.p. hydraulic drive system, and a bank of 6-V. batteries. It weighs about 8,000 lb., and can support its crew for eight hours (plus one day in emergencies). According to M. R. Snoey (N.C.E.L.) and E. M. Briggs (S.W.I.) who described NEMO at the Winter Annual Meeting of the American Society of

*NEMO, a transparent-hulled submersible with an operating depth of 600 ft., has now been declared safe and reliable. Main advantage of the acrylic hull is the obvious one: portholes are inconvenient.*



Mechanical Engineers, an acrylic wall actually provides more payload than steel within the 600-ft. depth range of this version of the craft, because thin steel shells are hard to manufacture with adequate uniformity.

Snoey and Briggs describe the functions of NEMO as "assisting and directing undersea diver construction teams, evaluating undersea hardware and instrumentation, and studying marine flora and fauna." These functions require that the craft be independently mobile, particularly in the vertical direction. For vertical motion, NEMO's anchor rests on the bottom while the craft winches itself up and down its anchor-cable. Horizontally, the hydraulic motors give it  $\frac{3}{4}$  knot forward or backwards.

The Naval Civil Engineering Laboratory was well represented at the A.S.M.E. meeting. NEMO was the subject of a number of papers, including one from the Naval Undersea Research and Development Center, San Diego, Calif., announcing that this particular model is safe and reliable for repeated dives to 600 ft., and giving a fatigue-life curve for the shell.

The Laboratory is also concerned in ocean-bottom earth moving. The Northrop Corp. is designing, under contract, machines for excavating the sea floor at 6,000 ft., remaining down there for 600 hours at a time. Northrop workers conclude that a remotely controlled sea-floor excavator, using sound in place of light for guid-



ance through the murky water, is feasible. They see their thinking as applicable also on land, wherever there is an element of danger. "A computer containing in memory the original terrain contour and the desired terrain contour may carry on the entire job, with only a human supervisor to assure that the computer and excavator have not malfunctioned," according to F. S. Cox and C. P. Buckley. Meanwhile, also under N.C.E.L. contract, WNRE Inc., of Chestertown, Md., has found that the traction of tracked vehicles moving across the sea bottom "will be predictable to a useful engineering degree."

## How to Find the Mutagens

Of the myriad synthetic chemicals of modern life, those that throw wrenches in your genetic works can be identified, and quite handily—a number of rather simple tests can be done to show whether a chemical is mutagenic or not, it transpired at a conference on Evaluating the Mutagenicity of Drugs and Other Chemicals (see Technology Review for January, 1971, p. 59), sponsored by the National Academy of Sciences this winter. This cheery news—that we are not totally defenseless—was wrapped around the not uncommon bad news that no studies of mutagenicity will be funded after next June, and the conferees uniformly stood out for more money.

All of the tests work basically the same way—an organism with a gene which can be easily watched is fed a suspected chemical. Any change in that gene will show, usually rather dramatically. For instance, a yeast colony will turn purple, from white, because it can use a food it couldn't before; a whole class of flies will simply not be born.

Tests on fruit flies, *Drosophila*, will show whether a chemical causes chromosomes to break and rearrange themselves, or whether a mutated gene overpowers or is overpowered by the normal gene paired with it. Tests on bacteria will show if a chemical causes the insertion, deletion, or substitution of one of the basic molecules, or the deletion of a chunk of a chromosome, or a mutation of a single gene. Tests with the fungus *Neurospora* are sensitive even to weak mutagens. A host-mediated assay, in which a lab animal is given a chemical and a yeast or bacterium, will, by showing mutations in the microorganism, find whether the chemical changes in the body to one which is dangerous.

Whether a chemical affects one gene or a whole chromosome (two quite different actions) or both, can be shown by using hamsters or other lab animals. Using an animal with a number of marked genes will show the range of damage that a mutagen can do, from a slight disability to death.

One more study can be done—to show, in humans, whether the rate of mutations is increasing. A few, perhaps 20, blood proteins are analyzed by electrophoresis. If their structure has changed, their electrical characteristics will be different, and they will reach

a different place on the strip. Dr. James Neel, of the University of Michigan, expects that electrophoresis can be automated, and a sample will cost about \$10 to run. Testing 1,000 people a day during the year would cost about \$3 million, and, he thinks, would be adequate to show if for some reason the rate of mutations jumps 50 per cent. (The cause of such a general jump, of course, would need quite another investigation.)

Most scientists felt, while carefully avoiding predictions of imminent disaster, that testing of chemicals should begin now, and that the whole range of tests should be used. Keeping to one test, though cheap and easy (with *Drosophila* or *Neurospora*), will not give enough information. Perhaps the cheaper tests could be used for basic screening, but one, or even two or three tests, will not fill in the whole picture.

Dr. Paul Calabresi, of Roger Williams General Hospital in Providence, seconded: "We ought to use the whole panel of tests—for chromosome damage and point mutations, for response to different dosages, for drug absorption, for interactions with other agents, for how it is used in the body."

"We must expect to make mistakes," added Dr. Crow. "All knowledge is tentative. We must act knowing that what we know is imperfect."

Tests might be financed, a listener suggested, by a use tax on additives and drugs. But questions of the program's total cost are rather irrelevant, Dr. Neel said. "I find such comments singularly lacking in perspective, in the light of the great amounts spent by the drug and pesticide industries. It would cost perhaps 1 or 2 per cent of that." And, he added, "in the light of some of the more ignoble programs we do fund."

Dr. Neel voiced a question on many conferees' minds: "What choice do we make about a slightly mutagenic pesticide that will prevent wide starvation?"

Doubtless, which test(s), who will do them, and who will pay for them will open many an unpleasant argument. Yet, "he who puts a new chemical into the environment ought to discover a certain amount of knowledge about its relationship to the environment—its melting point, its lipid solubility, and its ability to cause mutations," Dr. Matthew Meselson of Harvard stated. "Knowing that a chemical is not mutagenic is as important as knowing that it is." He asked, "What could be more important than our most precious possession—our genetic make-up?"

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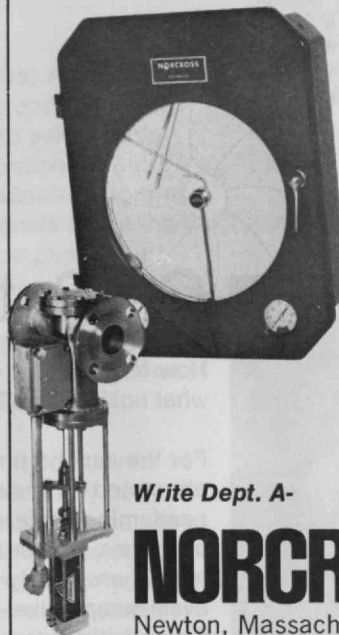
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## On Rating University Quality

How to judge the quality of graduate education? What is best, what good, what not-so-good?

For the second time in five years the American Council on Education has attempted an answer by assembling the collective judgments of over 6,000 academic scholars on faculty distinction and the effectiveness of doctoral programs in their fields at all U.S. universities which give doctorates. The results are widely regarded as a significant measure of the comparative—even competitive—quality of the nation's most prestigious institutions in the activities to which their prestige is most attributed.

Kenneth D. Roose, former Vice-President of the Council, and Charles J. Andersen of the Council's staff summarize their results this way:

◇ The 1969 survey covered more schools and more academic fields than the 1964 study—a measure of the five-year growth of U.S. graduate education. "The most dramatic development in the five-year period," they write, "has been an improvement in the rated quality of faculty in a large number of graduate programs."

◇ On the basis of their faculty quality, more schools are now rated in the highest brackets—and more in the lower brackets—than five years earlier. The authors' conclusion is that many long-established graduate programs have improved; but new programs have failed to achieve high quality.

◇ More institutions have added programs in the biological (first) and physical (second) sciences than in any other fields during the past five years. Astronomy is the discipline with the largest percentage increase of all programs surveyed.

◇ Two-fifths of the engineering programs covered by the A.C.E. survey showed improved faculty quality ratings in 1969-70 over 1964-65. Some 80 graduate programs in all institutions and all fields moved downwards in their ratings between 1964 and 1969; half of these were in the biological sciences, only nine in the physical or engineering sciences. Indeed, the faculty ratings in the physical sciences are the most stable of any in the A.C.E. survey.

◇ In five years there has been more change for the better in the faculties of institutions in the south and west than in other parts of the country.

◇ Evaluations of "effectiveness of graduate education" correlate very closely—as they did five years ago—with those of faculty quality; most academicians seem to agree that the effectiveness of graduate education is in fact determined by the quality of its faculty.

	M.I.T. Fac. Prog.		Calif. Inst. of Tech. Fac. Prog.		Rocke- feller Univ. Fac. Prog.	
<i>Engineering:</i>						
Chemical	4	7	9	7	—	
Civil	3	1	4	5	—	
Electrical	1	1	5	5	—	
Mechanical	1	1	3	3	—	
<i>Physical Sciences:</i>						
Astronomy	9	9	1	1	—	
Chemistry	5	5	2	1	23	21
Geology	4	4	1	1	—	
Mathematics	5	3	15	11	21	19
Physics	5	6	1	1	16	15
<i>Biological Sciences:</i>						
Biochem.	7	7	6	3	4	4
Dev. Biology	6	9	1	1	2	2
Microbiology	2	1	4	2	1	1
Mol. Biology	5	3	2	1	5	3
Physiology	7	7	5	5	1	1
<i>Social Sciences:</i>						
Economics	1	1	—		—	
Pol. Science	6	4	—		—	
Psychology	12	12				
<i>Humanities:</i>						
Linguistics	1	1	—		—	
Philosophy	11	9	—		—	

The table shows how the three highest-ranked U.S. schools whose basic organization is oriented to science and engineering ranked among U.S. universities in the disciplines included in the survey of graduate faculty quality completed early this year by the American Council on Education. (M.I.T. has no astronomy department; its rank in this field was apparently based on work in astronomy from the Departments of Physics and of Earth and Planetary Science.)

Numerical ratings were not published by the A.C.E. "to de-emphasize the pecking-order relationships," the authors write. But the temptation to compare institutions is irresistible, and the results can be important. The authors themselves admit that "a change in score range (between 1964 and 1969) may either lighten the step of a department chairman or bring him depression and anger," but they caution that very small statistical differences often separate first from second institution or improvement from status quo.

Irwin W. Sizer, Dean of the M.I.T. Graduate School, notes that A.C.E.'s evaluations of institutions will be important factors in many decisions that affect their future strength—the allocation of fellowship and scholarship resources, research grants, and industrial support; the selection by outstanding students who have opportunities to attend the graduate programs of their choice; and the decisions of distinguished professionals about the school whose faculty they will join. It is far more than a "compendium of gossip," as some critics have charged.

With few exceptions the prestigious institutions listed first by A.C.E. in 1964 remain at the top of the 1969 list; the notable exception is Columbia University, which ranks lower in almost every discipline than five years ago.

Harvard University stands first in the nation in terms of faculty quality in 14 fields of graduate education, the University of California (Berkeley) in 8 fields, according to the survey results. Berkeley appears among the top five institutions in 32 graduate fields, Harvard in 27. Logan Wilson, President of the American Council on Education, told the *New York Times* that "you can take your pick which one you want to rank first. It depends on which way you're looking at these institutions." Robert M. Smith of the *New York Times*, after studying the report, listed the nation's top six graduate institutions as the University of California (Berkeley), Harvard, Stanford, the University of Chicago, Yale, and M.I.T.

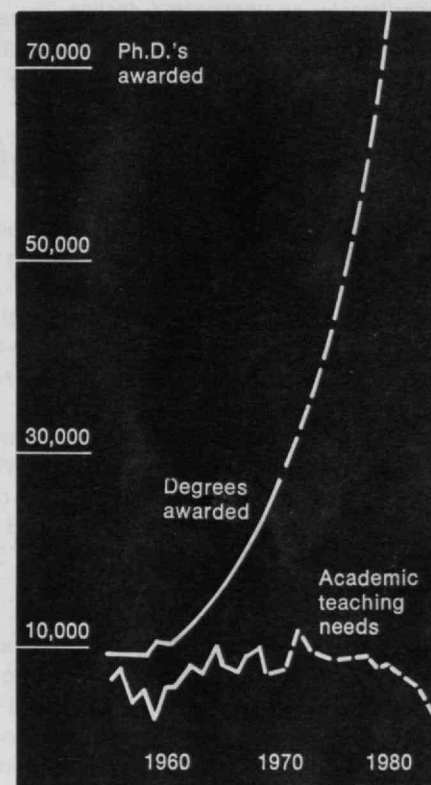
The study, designed primarily to serve major universities with broad programs, paid only modest attention to engineering and provided no evaluation of work in such professional fields as law, management, architecture, and medicine. Thus six of M.I.T.'s doctoral programs are in fields not surveyed, and others were evaluated only portions of their department's total offerings.

Of 19 disciplines represented at M.I.T., the Institute was deemed first in the nation in four for both faculty quality and program effectiveness, and in two others M.I.T. was first in program effectiveness (see chart). M.I.T. was in the "top-five" category in 12 disciplines on the basis of faculty quality; in five years the Institute's ranking went up in eight fields, down in two fields of the 11 represented in both 1964 and 1969 surveys.

The only other predominantly science institutions in the top ranks of the survey were California Institute of Technology and Rockefeller University; Caltech was rated first in four fields and in the "top-five" category in 13 of the 14 in which it was rated, and Rockefeller University was rated first in two fields and in the "top-five" in five of eight disciplines in which it was rated.

Howard W. Johnson, President of M.I.T., said the Institute's showing among the leaders in graduate education was "gratifying," and that its continued improvement over five years "not only in our core fields of science and engineering but in other research fields emphasizes the promise of higher education here in the coming decade."

Some 30,000 Ph.D. degrees were awarded in the U.S. in 1970, twice as many as five years earlier; but academic teaching, the traditional profession of the Ph.D., is hiring only 7,000 of these. If the curve continues its present trend until 1980, says Allan M. Cartter, Chancellor of New York University, the number of Ph.D. graduates will reach 80,000 a year; but the number of new teachers needed to maintain present academic standards will be—still—only about 8,000.



### Graduate Education Improves—and Grows out of Its Market

Five years ago, when Allan M. Cartter finished the American Council on Education's first evaluation of U.S. graduate education (see left), he startled many readers by suggesting that the then-predicted continuing shortage of Ph.D. graduates would turn out to be illusory. Unless the popularity of graduate study declined, or unless universities opted for "a marked further improvement in the quality of teaching staff," there might be a surplus instead of the freely predicted continuing shortage.

This year when Dr. Cartter—who is now Chancellor of New York University—came before the annual meeting of the American Association for the Advancement of Science, his audience knew he had been right. But even Dr. Cartter is surprised by the intensity and timing of

(continued on p. 68)



the problem: it is more severe—and five years earlier—than he had expected.

Now he believes that 30 to 50 per cent of the Ph.D. graduates of the 1970's and 1980's will have to settle for lesser jobs than they want. Even if all the junior colleges in the U.S. turn themselves into four-year institutions (where Ph.D. degrees are necessary for faculty) and even if all high school graduates go on to college, he said, by 1980 if present production trends continue there could not be enough academic jobs for all the science doctorates.

Several factors have come together at the beginning of the 1970's to yield this grim picture: a predicted decline in the growth rates of college and university enrollments; an unexpected decline in the prosperity of science-oriented enterprises; reduced federal support for research and education; reduced popular interest in the sciences.

Lee Grodzins, Professor of Physics at M.I.T. who organized the A.A.A.S. session at which Dr. Cartter spoke, is now conducting a major study of science manpower problems for the National Academy of Sciences. Dr. Cartter suggested easing the new graduates' problems by lowering the retirement age of senior professors. The tenured faculty will hang onto their ever-more-precious posts for decades to come, he admits, and they may become on the average less effective as they grow older.

The number of Ph.D.'s now actually unemployed or working in fields completely unrelated to their primary interest is now very small—perhaps 5 per cent of the total work force. But it will rise. The White House Office of Science and Technology has predicted, at best, a 6 per cent increase in federal money for basic research in 1971-72. "This," says Professor Grodzins, "will barely make up for inflation. If that's the best we can hope for, we will be in even sorrier shape in another year."

The Cooperative College Registry, a nonprofit organization which assists colleges in finding and filling jobs, says that in January, 1971, it had 25 per cent more registrants and 25 per cent fewer jobs than in January, 1970. And an American Chemical Society survey published early this year in *Chemical and Engineering News* reported that 10 per cent of the scientists and engineers then employed in chemical industry research and development may lose their jobs in 1971.

But Hugh Falk, Professor of Economics at the University of Illinois, is not so sure. No one can really predict the need for scientists in various research and development fields a decade hence. "If the SALT talks between the U.S. and Russia were to collapse, we'd go back to the arms race," Dr. Falk said. "And we would again have a shortage of scientists and engineers."

# The Research Squeeze

The sources of the frustrations of American science and engineering education—and its students—are obvious in the National Science Foundation's most recent annual study of college and university scientific activities released this winter. Increasing commitments to education and sharply decreasing campus research and development expenditures in 1968 could hardly fail—in hindsight—to yield today's surplus of job-seeking scientists with fresh new doctorate degrees.

From 1958 to 1966 college and university research and development expenditures grew at an average rate of 17 per cent a year; but in 1966 to 1968 the growth rate dropped to 11.7 per cent. By 1968 federal funds covered 60 per cent of this work. Hence the significance to N.S.F. of the Bureau of the Budget estimates that federal support of university research and development actually decreased by 2 per cent between 1969 and 1970 and could increase only 2 per cent between 1970 and 1971.

Meanwhile, college and university funds devoted to instruction and departmental research in science and engineering grew nearly 15 per cent a year since 1964, the first year in which N.S.F. assembled such statistics. Even before completing their graduate work young scientists and engineers were caught in the squeeze: the number of graduate students employed in teaching has grown consistently at 11 to 12 per cent a year since 1958, while the number employed in research grew 6 per cent a year to 1966 and less than 3 per cent a year from then until 1968.

## Toward Urban Understanding

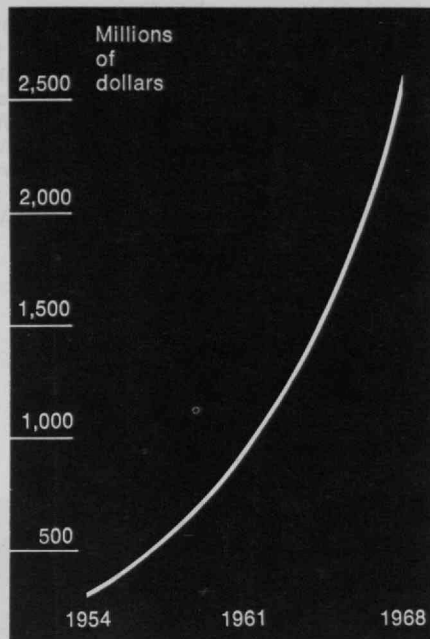
You are in a strange, large city. But before you is a National Urban Service center, with maps, a panoramic model of the city, a computer console which yields answers to your questions about where things are and how to find them, and a push-button-operated film loop to describe the city's history.

From the Center are designated paths, like Boston's "Freedom Trail," to cover the sights of unusual interest. Along the way are exhibits of what goes on in companies whose doors you pass—and, on some of them, invitations to watch the work in progress; orientation markers and games to help you visualize where you are and what happened here in years before; signs and comments to help explain how transportation flows before you, how—in fact—the city really works.

Then another Center, this one devoted to the city's ecology, or its ethnology, or its true place in people's lives.

Such a National Urban Service—the cities' counterpart of the National Park Service—is proposed by Lloyd Rodwin and Michael Southworth of M.I.T. in a recent issue of *Educational Technology*: "However rich the world of nature, the urban environment provides even greater potentials, for it is the living museum of our culture," they write. What is missing is a key "to the many places and ways in which the mind and eye can take an interesting journey," a way to help residents and visitors alike "to learn and to enjoy themselves as they move about the city," to help them understand its intricate functioning.

Professor Rodwin is head of M.I.T.'s Department of Urban Studies and Planning, and Mr. Southworth is a Research Associate in the Laboratory for Environmental Studies. As prototypes for their suggestion, they cite—in addition to the National Park Service—such plans as the N.P.S. "Summer in the Parks Program" in Washington, D.C., in the summer of 1968 and the Parkway High School program in Philadelphia, by which high school students travel around the city for various classes at various places. Yet, they say,



Current expenditures for research and development in colleges and universities maintained a healthy growth—17 per cent a year, far outstripping inflating costs—from 1958 to 1966 and a reasonable growth rate—11.7 per cent—from 1966 through 1968. But, says the National Science Foundation, "preliminary information for 1969 and 1970 shows a continued leveling off in federal research and development obligations that will result in considerably lower annual rates of growth in research and development performance." Indeed, the Bureau of the Budget anticipates essentially no increase in funding—and hence a net decrease due to inflation—between 1969 and 1971.

even these projects give evidence that "we have not recognized the potential for enjoyment and education which cities hold."

To do its job, the National Park Service spends about \$170 million a year, of which \$75 million is for historic preservation, new acquisitions and construction of roads, trails, and buildings. A National Urban Service might begin—on an experimental basis in a few cities—with between \$25 and \$50 million for grants on a three-to-one federal-local matching basis, to see what can be done and how to do it. If that sounds modest, as it does to the authors, it is because they want to avoid an overkill: "The American mania for labelling and packaging everything could seriously betray our aims. . . . We do not wish to create a city that gives the impression that everything is explainable."

"Another of our concerns is that the city might become a giant propaganda machine," they write. Instead, the National Urban Service work should "nourish critical evaluations of the city and help to bring about constructive changes. By making the interdependence of man and environment more explicit, the consequences of poor management are less apt to be overlooked."

## Hints for Planning Day Care

Businessmen take note: Women's Liberation may not have hit your corporation yet, but Day Care probably has. If not, it's doubtless on the way.

Here are some suggestions, deriving from one experience with starting a day care program for employees' children—M.I.T.'s, during the summer and early fall of 1970, which may hold useful lessons for others:

1. The numbers of employees who apply for places for their children at the outset of such a program are deceptively small. By early summer, M.I.T. had barely filled all of the 15 places which were available in the day-care center in which the Institute is participating. But as the word spread applications flooded in: the waiting list now has 35 names, and many will wait more than a year for places.
2. The pressure for admission will come as much from the more affluent suburbs as from the poorer sections of the inner city. M.I.T. based its day-care plans on a survey of employees living within five miles of the Institute; but the Planning Office, which analysed the results, notes that "this five-mile radius did not reflect the time-consuming, complicated public transportation routes . . . nor did it reflect the relatively easy commute of some employees living more than five miles away."
3. Don't neglect the advantages of day care for the child involved. Parents of children in the M.I.T. program are reporting great advances in their pre-schoolers' development in the few months they've attended the center.
4. An effective day-care program may substantially alter employee make-up. As news of the day-care plan spreads, more and more women employees with small children will find their way into the organization. Day care is also helpful in efforts to hire the disadvantaged.

M.I.T.'s day care is financed under a grant from the Mellon Foundation. It now enrolls 15 preschoolers in the Child Development Center established by KLH Research and Development Corp. nearby in Cambridge (see "One Company's Experience in Creating Employment Opportunities," by Henry M. Morgan, in *Technology Review* for June, 1968, pp. 30-35). M.I.T. pays the main portion of the \$37.50 it costs per week per child, and the parents pay the balance as payroll deductions.



# The Old Bull Uncornered

Edward Teller, physicist, is also a specialist in inconsistency. After Hiroshima, when many scientists who had worked on the atomic bomb left weapons work—Dr. Teller urged the development of the hydrogen bomb. During the McCarthy headhunting years, when many of these same scientists publicly defended their accused colleague, J. Robert Oppenheimer, Teller gave a testimony which, in effect, crucified Oppenheimer and ended his public career.

He is even inconsistent with the old saw that youth never agree with their elders; for today, Dr. Teller is the *bête noir* of the younger generation of scientists, too. To them he is almost mythical—the mad scientist Dr. Strangelove who wants to build more and more “beautiful” weapons for the sheer, fantastic delight of controlling Doomsday. Dr. Teller charged into the arena to meet these young attackers during a day-long visit on December 27 to the meeting of the American Association for the Advancement of Science in Chicago. Many times in his past, such confrontations have won Dr. Teller only unpopularity—even ostracism. But this time, the old bull won.

Teller has worked at the Lawrence Radiation Laboratory in Livermore, Calif., since 1952. He is known for his hawkish views on weapons development, including the A.B.M. And he is known for his ability to put down questioners, other scientists, youth, doves—in short, anyone he disagrees with—in a booming, angry voice and thick Hungarian accent undimmed by 25 years of U.S. residency.

But during his ten-hour performance at the A.A.A.S., Dr. Teller departed from this posture many times. He was gentle, even humorous with his challengers. To an astonished group of scientists and press, he announced that during the war, Leo Szilard had urged him to circulate a petition against the bomb they were developing and that he, Teller, agreed with it. But Dr. Oppenheimer, director of the laboratory at Los Alamos, talked him out of it. Even the great weapons champion had had doubts about the Bomb. Finally, Dr. Teller agreed to talk with a small group of radicals well

into the night, where he repeated a call for mutual understanding between all camps of science.

## “In the Presence of Propaganda”

The young radicals who planned to make fun of Teller at the meeting were a national coalition called Scientists and Engineers for Social and Political Action (S.E.S.P.A.), which claims 11 chapters and 2,000 “members.” In Teller, who is far from popular among his own generation, they thought they had a sure target. They decided to award him their “Second Annual Dr. Strangelove Award” at a panel titled (ironically) “Is There a Generation Gap in Science?” Word of the impending action spread well in advance, and by early afternoon the Upper Summit Room at the top of the Conrad Hilton Hotel was packed with some 600 people. It was the best-attended panel of the entire A.A.A.S.

The afternoon’s incongruities began with Teller’s entrance into the room full of chatting, genial conventioners—flanked by six bodyguards, apparently in response to threats of violence against him. But what followed was anything but violent. When he rose to speak, two S.E.S.P.A. men simply mounted the far end of the stage and stood silently, holding up the first of a series of placards introducing “The War Criminal: A Short Play by Edward Teller.”

His first reaction was a stock Teller performance. Booming, he announced that he had always refused to talk “in the presence of propaganda” and sat down.

But then, suddenly, he changed his mind, muttering something about consistency and inconsistency. With the aid of a bit of rough-riding by Dr. Margaret Mead, chairwoman of the session, over some vocal comments from the audience, Dr. Teller resumed control. He said he was worried by the cut of government funds to science and the plight of the universities. “I want to understand the reasons and respond.” He began to talk, with the silent S.E.S.P.A. placards still in place.

He talked about how he entered science

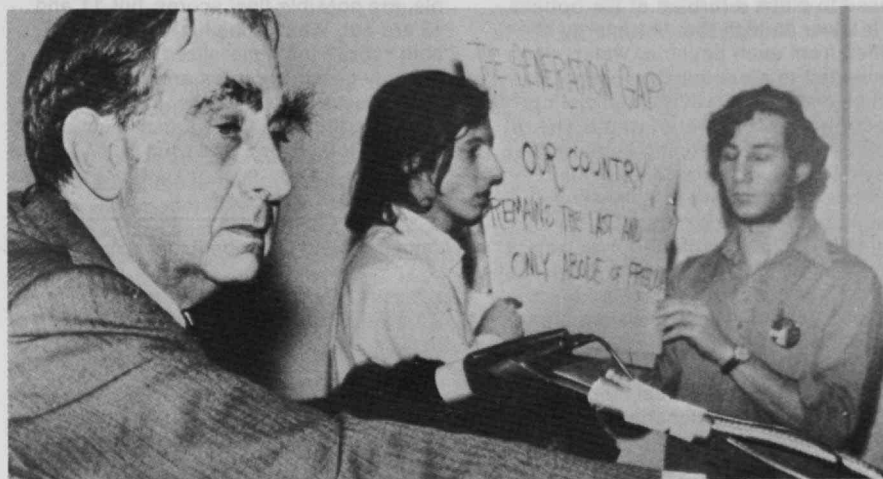
for the love of science. About his belief in the fundamental neutrality of scientific research (a new placard read: “The War Criminal as Poet: ‘The Hydrogen Bomb Came from the Sun and the Stars’ ”). About another typical Teller theme—war. “If there is a World War III, it will be more horrible than any of us can imagine. But it will not be the end of the human race. It will be the end of freedom, real liberalism, and reason.” (The latest placard echoed: “The War Criminal as War Criminal: ‘We Must Prepare for a Limited Nuclear War’ ”).

Then came his revelation. Leo Szilard, he said, wrote him while he was working on the bomb at Los Alamos, asking his help to “prevent killing by the atomic bomb.” Szilard asked Teller to sign and circulate a petition for a demonstration—only use of the new weapon. “I fully and heartily agreed,” Dr. Teller recalled. “Unfortunately, I did what I thought I was supposed to do. I took the piece of document to the director of the laboratory (the late Dr. Oppenheimer), who told me, ‘Szilard is using his influence as a scientist to influence political decisions. This is wrong. Don’t you sign it. Don’t circulate it.’ I made the great mistake of feeling relieved of my responsibility.

“The most beautiful opportunity was missed. We could have proved that science could end a war without killing a single individual. Instead, we killed 100,000. And ever since then there has been a rising tide of anti-science sentiment.” (The next placard was raised: “The Humility of the War Criminal: ‘Scientists Are Fallible.’ ”)

Later, Dr. Richard Novick, of the Public Health Research Institute for New York City, presented Dr. Teller with the Strangelove Award “on behalf of his excellent imitation of Peter Sellers.” It was a 10-inch silver statue of a man aiming a gun and inscribed, “I was just following orders.” Dr. Teller rose and announced with mock humility that he had received many awards in his lifetime, “many of them also undeserved.” But he had never refused one. And then, muttering more about inconsistency, he refused this one and plopped it back down in front of Dr.

Two demonstrators hold a sign commenting on physicist Edward Teller's remarks at the annual meeting of the American Association for the Advancement of Science this winter. Though his views are well-known, Teller surprised many and agreed to spend part of the evening talking with young radicals, the results of which encounter are described below.



Novick with a grand gesture. Even the radicals laughed.

#### "I Will Turn into a Pumpkin"

That evening, Dr. Teller agreed to meet with some of the S.E.S.P.A. people, and anyone else who happened by, in a tiny, gray, glaringly lit bedroom somewhere in the dim innards of the Conrad Hilton. His bodyguards were relegated to the hallway, playing cards, while a mixture of radicals and others, totalling 20 or so, crowded into the room which Teller, with his enormous frame, dominated easily. The session appeared to be chaired by a lady in heavy make-up whose main job seemed to be keeping tempers cool.

Like the afternoon panel, the evening discussion was a mixture of Tellers, old and new. He endured the same accusations of war criminal, stooge of the army, and the like, and retorted with his typical comparison of the radicals with Nazi youth.

But then he stopped his principal attacker, a long-haired student in an army jacket, glasses, and jeans named Tom Ward, and forced him to answer the question, "Do you *really* care about what motivates me?" Ward said yes, quietly, and Teller began his life story—again.

He was born in Hungary in 1908, "a land full of misery but optimistic about the future." He studied physics in Germany,

"but I knew what was coming." He sidetracked into a favorite topic: "Those who brought Hitler to power argued with the same type of venom I hear here." But then he retrenched, looking at Tom Ward: "One difference between you and them is that you behave differently when you stop and listen to the other side . . ." And then he was back to the life story. He fled Germany, went to Copenhagen, 1934, and on to London, 1935. To the U.S. in 1935 as a physics professor at George Washington University. "I then believed that scientists should stay out of politics." The confessional Teller went on: it was Franklin Roosevelt in a speech to the Pan American Union a few days before Hitler invaded the lowlands in 1939, which convinced him to join the war effort. Not surprisingly, the speech was a call to scientists to aid in the defense "not of the U.S. but of freedom."

Teller kept returning to his prepared—and undelivered—topic of the afternoon: the need to end secrecy in defense research. He also talked about freedom of speech—and appeared to practice it despite the incredible insults hurled at him. Of course the students wanted to talk politics. Teller maintained that he had no opinion on socialism or capitalism. But communism—well—that's something else. A friend of his had been sent to Siberia. . . . a good scientist, too. Often the lady in make-up had to intervene between the students and the "foe."

It was nearing 10 o'clock. The room had been a pressure cooker for over two hours by now. Teller was tiring; his face was whitening and there were puckers under his eyes. He had been brandishing his cane and stomping his feet all along—but now his pant leg lifted, revealing the brace on his right leg. He leaned often on the cane now, as though the frail hotel chair wasn't going to survive under his weight. The Old-World courtesies droned out: "And now, if you don't mind, I really must go. Or I will turn into a pumpkin. Ten minutes more. Only."

It was going to end. Everyone had agreed to stop arguing. There was almost a visible sigh of relief. The lady in make-up began an elaborate speech of thanks to Dr. Teller. She patted his arm and smiled at him dewily through false eyelashes. "There there, that wasn't so bad, was it?" Old-World courtesies sputtered back in reply. She gave him a loud kiss on the cheek. He winced.

And, of course, never to be cornered, he suddenly gained strength for another verbal charge: "Dear lady," he boomed, "if I had known how difficult it would be I would *certainly not* have come!" She recoiled a bit at that. At which point the huge frame lifted itself up from the chair and lumbered out of the room, and the bodyguards escorted him away.

The lady in make-up joined an informal de-briefing afterwards with the students, while Tom Ward slouched in the corner, unsmiling and talking in a low voice with his friends. The lady was sentimental and nodded towards Tom. "Teller says that boy's full of venom, but I think he's full of heartbreak. Think of the records he listens to, the heartbreak he's had. Think of what that boy's been through! Teller will never understand that."

Different students reacted differently: "He must be completely insane to do what he does and yet talk the way he did tonight." "I came away with a new appreciation of the man. He told us his life story. Not that he should be felt sorry for, but I saw that he was a man." "I think he said what was really on his mind." "I think he came clean with us and that scares me even more."



# Perpetual Motion Rides Again

A few requests: *Please* refer to problems by number. If you use some code name (e.g., "the monkey problem last spring") I will probably ignore your letter; contrary to (apparently) popular opinion, I do not have a photographic memory for problems and numbers. On a more pleasant note, bridge problems are still (January 19) in short supply, so please send along any you have found interesting. I am far from a bridge expert, so it is not advisable for me to have to make the selections.

## Problems

First the usual bridge problem—this one from John P. Rudy (and Alan Truscott of the *New York Times*):

**21** Given the following, show how South can complete the contract:

♠ 8 3		♠ J 7 4	
♥ K J 10 9 8 7 6 3		♥ 5	
♦ 7 2		♦ Q 10 5	
♣ 7		♣ K Q 10 8 6 3	
♠ A K Q 10 9 6 2			
♥ A 4			
♦ 6			
♣ A 5 2			

The bidding, North and South being vulnerable:

South	West	North	East
1 spade	4 hearts	5 diamonds	pass
6 spades	pass	pass	pass
West's lead is ♣ 7.			

**22** Dr. John Prussing wants you to show that the series

$$1! + 2! + 3! + \dots + k!$$

is asymptotic as  $k \rightarrow \infty$  to the sum of the last two terms.

Perpetual motion rides again. Smith D. Turner submits the following problem, noting that it may belong in the "Speed Department" because what is desired is an answer without advanced mathematics suitable for, say, a bright high school senior:

**23** From each pound of water passing through a hydraulic turbine we can get more and more energy as we increase the pressure head on the water. It is pro-

posed to place a turbine at the bottom of a tower so high that the energy obtained from each pound of water, when converted to electricity by a generator run by the turbine, will be sufficient to electrolyze that pound of water. The resulting gas mixture, being lighter than air, may rise through an adjoining shaft (wrapped in balloons of infinitesimal weight and infinite stretch, if this idea will help) to the top of the tower, where they may be ignited to reform water, condensed, and returned down the tower. The fact that units in the system are not 100 per cent efficient will not prevent operation, as the tower may be made higher than the theoretical height, producing enough additional power to offset losses. But no perpetual-motion system is economic unless power can be drawn from it. This can be done by making the tower still higher than necessary to electrolyze the water and offset losses; from the lifting effect of the rising gases; from the heat generated by the burning gases; and by use of the superheated steam formed by the combustion to power a turbine. Aside from possible *practical* difficulties (such as the height of the tower):

1. Will the system run as described?
2. If so, does it constitute perpetual motion; or, if not, from what source does the energy come?
3. If it would not run, point out any fallacy in the reasoning above.

Here is a navigation problem from J. J. Shipman and V. J. Knight:

**24** An airplane pilot flies a triangular course, flying first due north for a time  $t_0$ , then due south for the same time  $t_0$ , and finally returning by a straight line to his starting point. The course is triangular because of a wind of unknown direction and velocity  $V_w$ . Assuming the pilot has a stop watch and an air speed indicator which shows his speed relative to the air, and he maintains this air speed constant, how can he determine the direction and velocity of the wind?

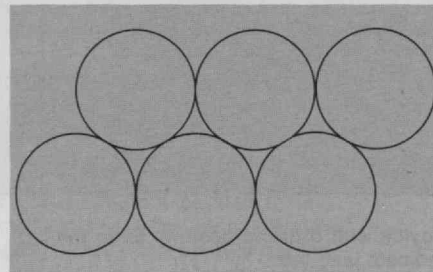
From Douglas J. Hoylman:

**25** Suppose that a football team scores only touchdowns and points-after-touchdown—i.e., that all scores are either 6 or 7 points. Then 12, 13, and 14, for exam-

ple, are possible final scores, but 11 and 15 are not. What is the highest unattainable score? In "generalized" football, the only possible scores are  $a$  and  $b$ , both integers being greater than 1. Under what conditions is there a maximum attainable total score, and what is it?

## Speed Department

James R. Bledsoe submits the following:



**SD7** Given six coins touching each other as shown. Form them into a hexagon (circle) in three moves, moving only one coin at a time. The coins must be moved by sliding (not picked up), and each time a coin's position is altered it must be moved to a spot where it touches two other coins.

Finally, from Frank Rubin:

**SD8** In an idle moment I stretched a string around the earth's equator (about 250,000,000 in.). Unfortunately, the string was 1 in. too long, so I built a tower to hold the string taut from one point. How tall was the tower?

## Solutions

**6** Given the following hands, and West's lead of the ♣ 5, how can South make seven hearts?

♠ —		♠ —	
♥ 10 9 8 7 6		♥ K J 9 8 7 6	
♦ A K		♦ 5 4 3 2	
♣ A 10 9 8 7 6		♣ K Q J	
♠ 5 4 3 2		♠ A Q 10	
♥ —		♥ A K Q J	
♦ 6 5 4 3 2		♦ Q J 10 9 8 7	
♣ 5 4 3 2		♣ —	

My girl friend says that it does her heart good to see a husband and wife work together. Hence the following solution, from Liz and Neil Doppelt, was a unanimous choice, even if Alice and I don't agree on the definition of working together. The letter is from Liz Doppelt: "Neil and I are really pleased about the monthly bridge problem, as we compete to see who can solve it first. This month I won. South wins the club lead with the ♣ A in dummy and pitches a diamond from his hand. He then leads a heart from dummy, winning in his hand. The ♠ A is led and dummy pitches the ♦ K. The ♠ 10 is led and ruffed, and another trump is led. South again leads a spade and ruffs in dummy. A trump is led and, after winning, South plays his last trump and pitches the ♦ A. All trumps are out and the declarer's diamonds are all good."

Also solved by the longest list of readers—43—ever known to respond to a single problem in Puzzle Corner. This list is simply too long to print, which says something about the popularity of bridge problems with readers of *Technology Review*—or perhaps something about the problem, which was originally submitted by C. C. Crystal.

7 Fill in the array below with 36 digits such that the six-digit number "a," read left to right, equals the vertical number "A," read top to bottom;  $b = B$ , etc.; and also so that  $b = 3a$ ,  $c = 2a$ ,  $d = 6a$ ,  $e = 4a$ , and  $f = 5a$ .

	A	B	C	D	E	F
a						
b						
c						
d						
e						
f						

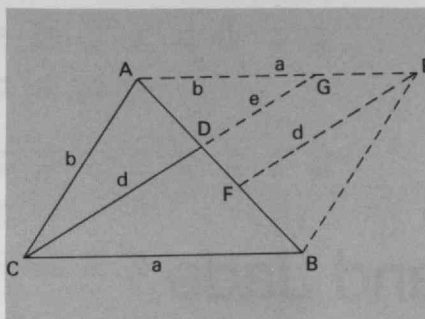
The following is from Harold Donnelly: By testing the last digit of A to be  $a_0$ , where  $a_0 \in \{1, 2, \dots, 9\}$ , then digits of f must be  $a_0$ ,  $3a_0 \bmod 10$ ,  $2a_0 \bmod 10$ ,  $6a_0 \bmod 10$ ,  $4a_0 \bmod 10$ , and  $5a_0 \bmod 10$ . Divide f by 5 and see if we get an A ending in the proper last digit. The only possibility is  $a_0 = 7$ . The solution:

	A	B	C	D	E	F
a	1	4	2	8	5	7
b	4	2	8	5	7	1
c	2	8	5	7	1	4
d	8	5	7	1	4	2
e	5	7	1	4	2	8
f	7	1	4	2	8	5

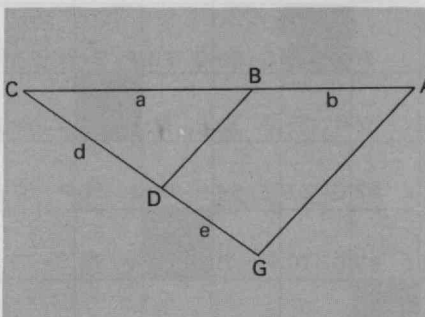
Also solved by Bob Baird, John D. Chisholm, Daniel S. Diamond, Leon M. Kaatz, Deena Koniver, Hubert duB. Lewis, Henry Lett, Victor J. Newton, R. Robinson Rowe, Greg Schaeffer, Frank G. Smith, and Mary J. Youngquist.

8 Given the lengths of two sides and the included angle bisector, construct the given triangle using compass and straight-edge.

This answer came from Robert Pogoff: In  $\triangle ABC$ , CD bisects angle ACB;  $CB = a$ ,  $CA = b$ , and  $a > b$ .

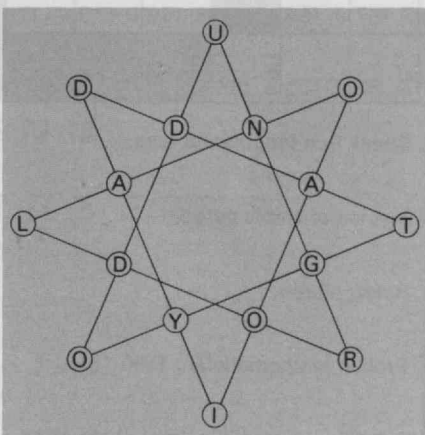


Draw AE parallel to CB; BE parallel to CA; and EF parallel to CD. Extend CD to G. Let the length of DG = e. Then angle AGC = angle GCB = angle ACD; therefore  $\triangle AGC$  is isosceles:  $AG = AC = b$ .  $\triangle BEF \cong \triangle ACD$ ; therefore  $EF = CD = d$ .  $\triangle AEF \cong \triangle BCD$ ; therefore  $AE = CB = a$ .  $\triangle AGD \sim \triangle AEF$ ; therefore  $e/d = b/a$ .



The problem, then, is given a, b, and d, determine by means of parallel lines, the length of e of DG, based on the proportion above. Construct a triangle AGC with sides of lengths b, b, and  $(d + e)$  as in the upper figure. Construct angle GCB = angle GCA. Lay off CB = a. Join A to B.

Also solved by Harold Donnelly, S. Lindenberg, Mrs. Martin, R. Robinson Rowe, and Greg Schaeffer.



9 The numbers from 1 to 16 were written in the circles of the diagram below in such a way that the sum of any four numbers in a straight line was the same. Then the number 1 was replaced by the first letter of a saying, number 2 by the second letter, etc. The final configuration is shown. What was the saying?

No one gave his reasoning but three

people, in addition to the proposer, Walter Penny, agree that the saying is "Do a good turn daily." The solutions came from Bob Baird, Hubert duB. Lewis, and R. Robinson Rowe.

10 Under what additional conditions is it true that  $6x + 1$  or  $6x - 1$  is a prime number when x is a counting number?

R. Robinson Rowe has a partial solution: In constructing a Sieve of Eratosthenes, the first two steps delete (as composite) all integers divisible by 2 and/or 3, leaving, in particular, all numbers of the forms  $6n - 1$  and  $6n + 1$ . Beyond the primitive 2 and 3, all primes are of one or the other of these forms. It so happens that for  $n = 1, 2, 3, \dots$  one or the other generates a prime up to  $n = 20, 24, 31, 34, 36, \dots$ . Hence for this particular problem, the proposition is true for n less than 20.

## Better Late Than Never

Additional solutions have come to several of last year's problems and one of this year's, as indicated:

- 14 Homer D. Schaaf
- 20 Robert J. F. Roughley and D. Wehn
- 24 Norman Apollonio
- 27 Norman Apollonio, J. R. Bledsoe, and (with a generalized version) George L. Uman
- 28 Anonymous
- 37 Raymond Mancha
- 43 W. C. Backus
- 1 Michael Kay and W. C. Backus

The following, concerning last year's problem 41 (the "canary problem"), comes from Joel Pitlor, who asks what is wrong with his reasoning: Consider the canary and submarine as a system with the sum of all the external forces equal to zero. The center of gravity of this system is at some point between the canary and the submarine. Since the sum of all the external forces is zero, the center of gravity of the system cannot move. Therefore, as the canary moves down, the submarine must move up to maintain the position of the center of gravity.

Allan J. Gottlieb, who teaches mathematics at Brandeis University, graduated from M.I.T. (S.B.) in 1967. Send new problems, solutions, and comments to him at the Department of Mathematics, Brandeis University, Waltham, Mass. 02154.



A. Speak in a lengthened tone.

B. Invoice of ship's cargo.

C. Refer; allude.

D. French mathematician, 1580-1637.

E. Condition due to intestinal obstruction.

F. Plant parasite.

G. Nerve cell branches.

H. Sweetly fragrant.

27 106 12 109 120

54 160 101 4 177 129 40 121

122   133   8   147   22   165

60 21 141 159 103 70 36

117      53      83      183      17

77    14    93    7    144

108	166	29	10	15	79	111	3	45
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55 104 63 128 158 86 127

I. Very hard, heat-resistant metal  
(2 words).

92 11 123 81 31 69 107 56 143  
44 89 176 156

J. Having high blood pressure.

112 168 41 61 97 180 16 80 90  
50

K. The southeast wind.

76 39 132 52 116

L. The harp.

175 59 146 42

M. Increase in value due to natural  
causes (followed by Word Q).

19 150 124 35 26 87 174 6

N. Variety of apple (2 words).

135 38 181 48 173 94 161 5 85  
140 67

O. C.G.S. unit of magnetic flux density.

136 179 119 18 65

P. Intestinal flora, for example.

24 100 118 71 98 170 84 57 88

Q. Word M.

134 62 99 58 23 157 142 78 178

R. Muddies; irritates

164 131 9 82 148

S. Branch of applied science devoted  
to industrial use of organic raw materials.

130 2 105 184 126 73 30 162

T. Arrow poison.

64 154 163 66

U. Decoys; baits.

13 155 20 115 102

V. Written sworn statement.

72 139 47 32 171 96 34 28 151

W. Radioactive element.

1 114 125 43 149 145 75

X. State of equilibrium in the earth's  
crust.

37 91 46 68 113 169 137 95

Y. State in eastern U. S.

25 152 110 138

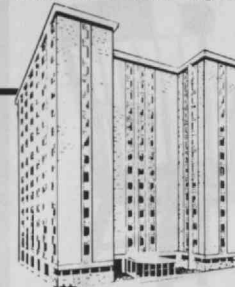
Z. Less valuable kind of jade.

33 74 51 49 167 182 172 153

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Anthony D. Kurtz, 1951

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| <input type="checkbox"/> M.I.T. Cushion                   |                 | \$11.   | -----         |
| <input type="checkbox"/> M.I.T. Director's Chair, Natural | Express collect | \$17.95 | -----         |
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TR-71

# Institute Review

## The Commission: Giving Form to "Good Intentions"

The wish of the Commission on M.I.T. Education for a broadly based discussion of the issues raised in its first report (see *Technology Review* for January, pp. 89-97) was granted almost immediately and continues so briskly that no consensus of community opinion on the report—or upon any of its specific proposals—is yet possible. Indeed, only in January were students and faculty led through the considerable rhetoric of the report to center their attention on two proposals for debate and action:

◇ The establishment of a First Division, to have direct responsibility—including administrative and budgetary—for the education of freshmen and sophomores.

◇ The election of an Institute Council, to represent administration, faculty, students, staff, employees, alumni, and the City of Cambridge, to be consulted and make recommendations on "any aspect of the governing of the Institute" and "any general issue related to its welfare."

Among compliments and criticisms, perhaps the most outspokenly critical view of the Commission report came not from M.I.T. but from overseas. The Cambridge correspondent of Britain's distinguished scientific weekly, *Nature*, wrote December 12 that "the report reads very much as the lowest common denominator inflated with some truly ghastly expressions of good intentions . . . (which) provide no concrete help in achieving creative renewal. . . . The voluminous prose seems to cover up a genuine inability to answer very specific questions."

To which the Commission may well respond that its intention was less to answer than to raise questions—the process of answering to be conducted under its leadership during the rest of this academic year. The dialogue, then, is just beginning.

### To Soften or Broaden?

In his initial presentation to the M.I.T. faculty on December 16, Professor Kenneth M. Hoffman, Chairman of the

Commission, was at pains to emphasize the Commission's desire to retain for M.I.T. the basic characteristics of an institution centered in science and mathematics. But he also stressed the Commission's conclusion that M.I.T. "must become more reflective, addressing the fundamental intellectual issues of knowledge and value." This, he said, would require changes "as significant as any in the past"; he reiterated that M.I.T. should effect such changes "without losing the hard, analytical institution that we are. We want to add a new set of concerns," he declared, "while remaining as great as in the past."

But Rene H. Miller, Head of the Department of Aeronautics and Astronautics, remained skeptical. In a letter to the Commission in December he suggested that students already spend markedly less time on academic work than used to be traditional at the Institute. "Intensive dedication to acquiring technical skills," he said, "... seems to be the necessary atmosphere in which a true professional is trained. . . . Our disciplines are hard and the training rigorous; . . . we must hesitate before we soften this atmosphere to the detriment of its product."

At the December faculty meeting, Victor F. Weisskopf, Head of the Department of Physics, made a statement with similar force. It is true, he said, that the problems of today will not yield to narrow solutions. But if we imply that students can go too deeply into a single specialty, we make a great mistake. "It is clear to me," he declared, "that we need people extremely well trained in their specialties. . . . Deep knowledge and understanding must remain. You can only serve society if you have learned your trade very well. . . . We have to teach students the fundamentals, and teach them well."

### What Was Left Unsaid?

In his "minority" report, Arthur Steinberg, Associate Professor of History and Archeology—the only member of the Commission who declined to sign the Commission's report—chided the Commission for not pressing harder. He argues that "our students are still too constrained; that they choose from too narrow a range of science, and even

humanities, subjects; that the list of science distribution subjects notably lacks entries in the 'general science' category; that the laboratory subjects have not brought students the kind of freedom to experiment that they would benefit from; that the failure of the first two years is intellectual and not structural, and that the central problem is lifeless teaching that fails to make clear the larger relevance and the full possibilities of subjects being taught."

Indeed, Laurence Storch, '71, a member of the Commission, provided a qualifying statement in which he complains that the report "concerns itself with minimal adjustments of an institution which requires major creative change if it is to retain its viability." He says the Commission fell short of its mark by not—at least not yet—adequately considering such issues as future financial resources, *de facto* politicization at M.I.T. "resulting from its heavy dependence on government money," the Institute's responsibilities to Cambridge, optimum size and organization of the Institute, inbreeding of the faculty, and admission and financial aid policy.

Others, too, sought the Commission's advice on issues not covered in its report. Dr. Benson R. Snyder, Dean for Institute Relations, told *The Tech* in November that the Commission's "most serious oversight" was its failure to discuss the Institute's problems and opportunities in educating blacks and other minority groups. George J. Flynn, '69, a member of the Student Committee on Educational Policy, said he believed the reward system of grades and degrees—not covered in the report, except in an appendix by Charles E. Mann, '72—was of special interest to students. Other members of the community noted that the Commission made no serious effort to weigh various Institute activities—and the Commission proposals themselves—against the funding constraints which were freely predicted.

### Undergraduate Education

Alex Makowski, '72, Editor-in-Chief of *The Tech*, found the Commission's most valuable contribution its proposals for a "new direction for undergraduate education. . . . Within a system that



rewards technical expertise, . . . students were bound to mature intellectually into narrow professionals. The solution is a climate emphasizing an integrated education," he wrote. There was lively debate on the First Division—the Commission's proposed mechanism for implementing many of its suggestions on undergraduate education—at an open meeting held by the Commission in January; *The Tech* paraphrased the discussion this way:

Robert G. Gallager, Professor of Electrical Engineering: The First Division could group together the undergraduate faculty within an atmosphere of educational enthusiasm—a spirit which they might carry back to their departments.

John C. Graves, Assistant Professor of Philosophy: The proposal is wrong if it implies that there is one single educational plan appropriate for all undergraduates; and discussion of administrative details is premature until that issue is resolved.

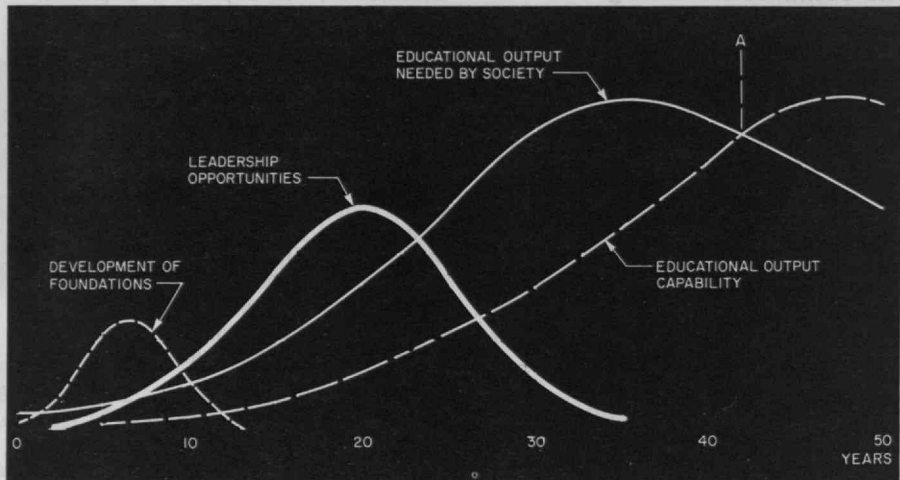
Duncan K. Foley, Assistant Professor of Economics: Much of the success of a First Division, if established, would hinge on its prestige and its ability to command some of the funds and other resources which are now devoted to undergraduate education within the departments.

Carl W. Garland, Professor of Chemistry: The First Division proposal is hazardous. There are advantages to bringing students into departments early in their undergraduate experience—especially to those students who come to M.I.T. with a strong interest in a particular field and maintain that interest.

Leon Trilling, Professor of Aeronautics and Astronautics: But the First Division as proposed would give students a more even exposure to all the opportunities which M.I.T. offers and thus a better basis on which to choose their future programs.

John C. Graves: What about the relation between First Division and the academic departments? Will the First Division in fact prepare students adequately for the flexibility which is now provided for juniors and seniors in the departments?

**The Humanities, Knowledge, and Value**  
The Commission's criticism of undergraduate teaching in the humanities—"a majority of students treat the humanities offerings as a diversion"—found sympathy with Thomas B. King, Head of the Department of Metallurgy and Materials Science. Early in January the Commission released his observation, in response to the report, that "the division between the humanities and technology at M.I.T. is indeed real and seems to be increasing with the passage of time. . . . The idea that students should grow up with science and humanities presented in separate packages and from antagonistic points of view seems to me intolerable."



How does an educational institution of limited objectives—such as M.I.T.—decide on goals and priorities? What should be its resource allocation processes?

These questions, says Jay W. Forrester, S.M.'45, Professor of Management, are central to many issues raised for the Institute by the Commission on M.I.T. Education. In a separate paper published by the Commission as an appendix to its report, Professor Forrester proposes one possible decision criterion for the Institute: attempt "to maintain the pioneering and leadership position which has characterized M.I.T. through most of its first century."

To explain—but admitting that the explanation fails to comprehend many details of the processes involved—Professor Forrester proposes this chart (above) of the time phasing between stages in research and educational activity. During the first decade of any development, he says, only a few innovators have perceived the problem and opportunity. The major chance "for moving into the forefront in research and . . . education" peaks 20 years later. Then the leadership spreads to many more institutions, and the output of education and research rises to eventually exceed society's needs. Point "A" on the chart represents

that point when society's declining need crosses the still-rising output from education and research—the moment of over-expansion when the educational system has exceeded its usefulness.

Professor Forrester's conclusion: "If M.I.T. is to maintain a research and educational position of leadership, it must develop methods for identifying and encouraging those ideas which are in the foundation-laying stage between zero and 10 years on the graph and which may not rise to their greatest recognition by society for another 30 years. . . . Major resource allocation should be going into those 'leadership opportunities' that lie, on the graph between 10 and 20 years. . . . These are activities which have not yet developed the strength to exert major pressures for resource allocation.

"M.I.T. should be forcefully withdrawing from activities that are in the phases after year 30 on the graph. This means withdrawal at the very time that the public demand seems the greatest.

"It is fairly clear," writes Professor Forrester, "that M.I.T. is not now organized to maintain a leadership position. It is in a defensive position, with too much of its activity lying in the right-hand half of the chart."

But Professor King sees the granting of B.A. degrees and teacher training programs, both discussed (though not advocated) by the Commission, as "further moves toward separatism."

A different view from David Spitzer, an editor of the student newspaper *Thursday*: "Until we rid ourselves of having only one perspective, we cannot possibly have the diverse, chaotic, challenging, fruitful, 'humanistic' environment we want. Why look at science and humanities as two conflicting entities—why not as two aspects of the same desire, the desire to control and order the universe with our minds?"

#### Toward Decision and Action

How to "get a purchase," to begin action on such a comprehensive report? President Howard W. Johnson asked the faculty after Professor Hoffman's first presentation on December 16. Hartley Rogers, Jr., Professor of Mathematics, proposed an answer: concentrate on two substantive recommendations of the Commission—to create the First Division for underclass education, and to create an Institute Council to broaden the base of governance. Though he admitted that "institutional experiments have a way of being irreversible," he said he was ready to accept both proposals on trial basis. The First Division could be anything from "a kind of bland bureaucracy" to "a hardnosed focus of power insensitive to the traditional values of a distinguished faculty." But he said the Commission's proposition is very simple: "M.I.T. should make a more concerted effort in the area of undergraduate education"; and it is a proposition with which no one can argue.

Though the Commission in various sections of its report wrote of providing a greater part for all members of the community in "the important decisions that affect the character and role of M.I.T.," the proposal for a Council is simply for an advisory, consultative body. Professor Rogers admitted that the Council may be "a meaningless public relations operation," or it may be "a contentious, time-consuming arena of parliamentary maneuver." He wants neither, but he associates with consultation a "greater emphasis on accountability." He approves the concept of a Council for this purpose because of his "belief that it is a special genius of parliamentary bodies, as opposed to bureaucratic bodies, that they adjust their level of activity to the needs and challenges that face them."

#### 97 Per Cent Success

Ninety-seven per cent of M.I.T.'s Class of 1973 received passing grades in their first two terms of work at M.I.T. in 1969-70 under the pass/fail grading system, according to an analysis made for the Committee on Academic Performance. Between 1 and 2 per cent of the class received failing or incomplete grades in the two terms.

Meanwhile, 37 per cent of upperclassmen received grades of A and 32 per cent grades of B in the first term of the same year; 3 per cent of the grades given were failures, 4 per cent incompletes. By the second term more than 60 per cent of the upperclassmen were enrolled in pass/fail grading plans, and there were no failures; 26 per cent of the grades given to other upperclassmen were A's.

Among all undergraduate subjects given in the first term of 1969-70, three had failure rates of 9 per cent or higher: 2.01, Mechanics of Solids (a first course for most students entering mechanical engineering); 8.02, Physics II (the second term of "freshman" physics); and 21.641, an elective course in symbolic logic given in the Philosophy Section of the Department of Humanities.

#### Selective Service Report

Two years after Congress made most graduate students ineligible for Selective Service deferments, and one year after Selective Service priorities began to be determined by lottery, what are the effects on education at M.I.T.?

Graduate enrollment is not seriously reduced or demoralized by draft calls, as some once feared. Indeed, many local draft boards continue to grant deferments to graduate students who hold teaching assistantships—and sometimes to students who hold research appointments—on the basis that their work is in the "national interest."

Undergraduates continue to receive 2-S (student) classifications upon annual application. The number of undergraduates who postpone their degrees by enrolling in five-year programs leading simultaneously to bachelor's and master's degrees is somewhat increased. But M.I.T. does not see this as an abuse of the system, says Sanborn C. Brown, Ph.D.'44, Associate Dean of the Graduate School; such programs are "sufficiently challenging to require students to be committed to their educational purposes, and traditional high standards are being maintained," he says.

For both groups, says Dean Brown, the lottery system seems to "substantially reduce" student anxieties.

M.I.T. was startled this winter to find itself charged—along with some 90 institutions in 11 states—with "reluctance . . . to cooperate" with Selective Service in providing information on student deferment cases. When the dust settled, it became apparent that Curtis W. Tarr, national Director of Selective Service, was complaining because colleges do not take what he considers a "moral" obligation greater than any the law requires.

Selective Service law specifies that colleges will certify the status of every student when he applies for his annual undergraduate draft deferment and at

other times on request. Otherwise, students are required to themselves report any changes in their status which might affect their deferment. Mr. Tarr seemed to be suggesting that colleges preempt this student responsibility—to which Dean Brown responds that colleges have no authority to do so. And in any case, he says, M.I.T. "has the feeling that students are adult and can meet their own responsibilities."

#### Charles D. Coryell, 1912-1971

Charles D. Coryell, Professor of Chemistry at M.I.T. since 1946, when he pioneered the field of nuclear chemistry at the Institute, died at New England Deaconess Hospital in Boston on January 7. He was a victim of cancer, after a long struggle against the disease in which the nuclear materials which his research had helped to make available were essential tools.

Professor Coryell, a native of Los Angeles, studied at California Institute of Technology (B.S. '32, Ph.D. '35) and later taught there and at the University of California (Los Angeles) until 1942. During this period his work was in the field of magneto chemistry and the structural chemistry of hemoglobin derivatives—and other problems in physical inorganic chemistry.

Dr. Coryell served with distinction for four years during World War II at the Metallurgical Laboratory, Chicago, and the Clinton Laboratories, Oak Ridge, Tenn., when he began uniquely important work in nuclear chemistry, including extensive study of the isolation and identification of fission products.

After coming to M.I.T. in 1946, Professor Coryell's work continued to center in those aspects of physical, inorganic, and structural chemistry which are basic to nuclear science and in the chemistry of nuclear transmutations, particularly of nuclear fission.

For these achievements in nuclear chemistry Professor Coryell last year received the U.S. Atomic Energy Commission citation; he also held the American Chemical Society's award for nuclear applications in chemistry (1960).

#### Talent Available

To help bring displaced professional workers to the attention of potential employers, *Technology Review*, in cooperation with the Director of Placement, will inaugurate a monthly column of "positions wanted" announcements in the April, 1971, issue. Statements for publication, not to exceed 50 words and indicating background, training, and current professional interests, should be sent to the *Review* at Room E19-430, M.I.T. The service is limited to alumni of the Institute; names will not be used, and each announcement will be assigned a key number for reply.



"M.I.T. will proceed on its great task as the outstanding educational institution in the world, founded on a basis of science and its applications. . . . Its health and stature will depend, to no small degree, upon the support of the loyal body of alumni who think more deeply than the trivial things, who are determined that this institution shall go on to greater things and who, in that determination, will help to make it what it is going to be"

# The Endless Alliance

A few years ago there was a so-called student riot at M.I.T. Spring had stirred the blood of students and some of them interrupted traffic for a while on Massachusetts Avenue. No other harm was done, and it was a good-natured affair.

It happened that the next evening I was to make a speech at Burton House, and a question came up about the riot. I told them that the students of the day disappointed me, that I could remember a time when students at M.I.T. seemed to have the spark of ingenuity, even a touch of humor, but that I was discouraged about the present generation; all they could do, it appeared, was drab repetition of dull affairs.

A few days later there was scheduled the ground-breaking for the Green Building. Surrounded by a small group, Cecil Green and President Julius Stratton operated a two-handled shovel and turned over a piece of turf. I was standing on the outskirts of the crowd, and when the ceremony was over I was approached by three students. They asked me if I remembered my remark at Burton House; I said I did. Then they told me that at midnight of the previous night they had carefully buried two bushels of beef bones at the exact spot where the turf was to be turned over. Unfortunately Cecil and Jay had dug their hole four feet away.

Now I tell this story for a reason. Everywhere I turn today I find prophets of doom: the country is going to pot; in particular, the universities are finished. I fear that we are losing our sense of perspective. Worse, we seem to be losing our sense of humor.

I agree that we have plenty to worry about. Some of our young people, in dirty pants and bare feet, are evidently soaking up drugs in considerable quantities. The crime rate has risen appallingly. A judge is pulled out of his court and dies. Police are shot in the back by snipers. Campus buildings are burned. Deans are assaulted. A bomb destroys a college laboratory and kills a researcher.

Our courts seem to be in utter confusion. I read of a murder trial entering its third month, of another in which only three

jurors have been picked after two weeks. I know that, at this rate, only a small fraction of murderers can be tried at all. I hear of an embezzler, convicted after an elaborate trial, free and active after several years while appeals are juggled from one court to another. I view a Supreme Court, after all responsible for the way in which the lower courts operate, doing nothing that I can discern to render our overelaborate and chaotic system of justice more able to perform its primary duty of protecting the public.

I witness a House of Representatives passing, without debate or review, a proposal for a far-reaching constitutional amendment which its members know makes no sense and would make a great deal of trouble, with its eyes firmly fixed on early November. I see a President surrounded by a staff organization for which I am sure no man could draw an organization chart and about which I suspect he is himself equally confused.

I still see, after many years, a war in Vietnam being fought by draftees, a police action on a grand scale which we should have had the sense to avoid and which we should have started to fight long ago on the basis of a volunteer combat force. And I see a whole country thoroughly disturbed because our selective service system is on the point of breaking down, likely to leave us in a perilous state if we should encounter a real emergency. And in our colleges and universities I have seen violence, disruption, defeatism, sheer absurdity which I do not need to enlarge upon before this audience.

So we have plenty to worry about, and in this country we seem to have lost our sense of humor. As I turn to magazines, to television, even to conferences among men, I find real heartening humor nowhere. I find discussions of abnormal psychology, of sexual perversions, of racial stresses, but no humor worthy of the name. I find no Will Rogers. And this is serious, for that nation which loses its sense of humor loses also the courageous spirit which conquers ills. The youth who boarded his pursuit plane during the battle of Britain, knowing full well that his chance of returning was near zero but who boarded with a smile

and a bright quirk, is no longer among us. We have lost our bright spirit, and with it we have lost our perspective. The times are tough.

But let us look back, and see if we can recover balance.

Let us, in fact, look way back. At the battle of the Somme in the first great war Britain lost in a single day 60,000 men, more than we have lost in a year of Vietnam. Britain mourned, but she tightened her belt and went on.

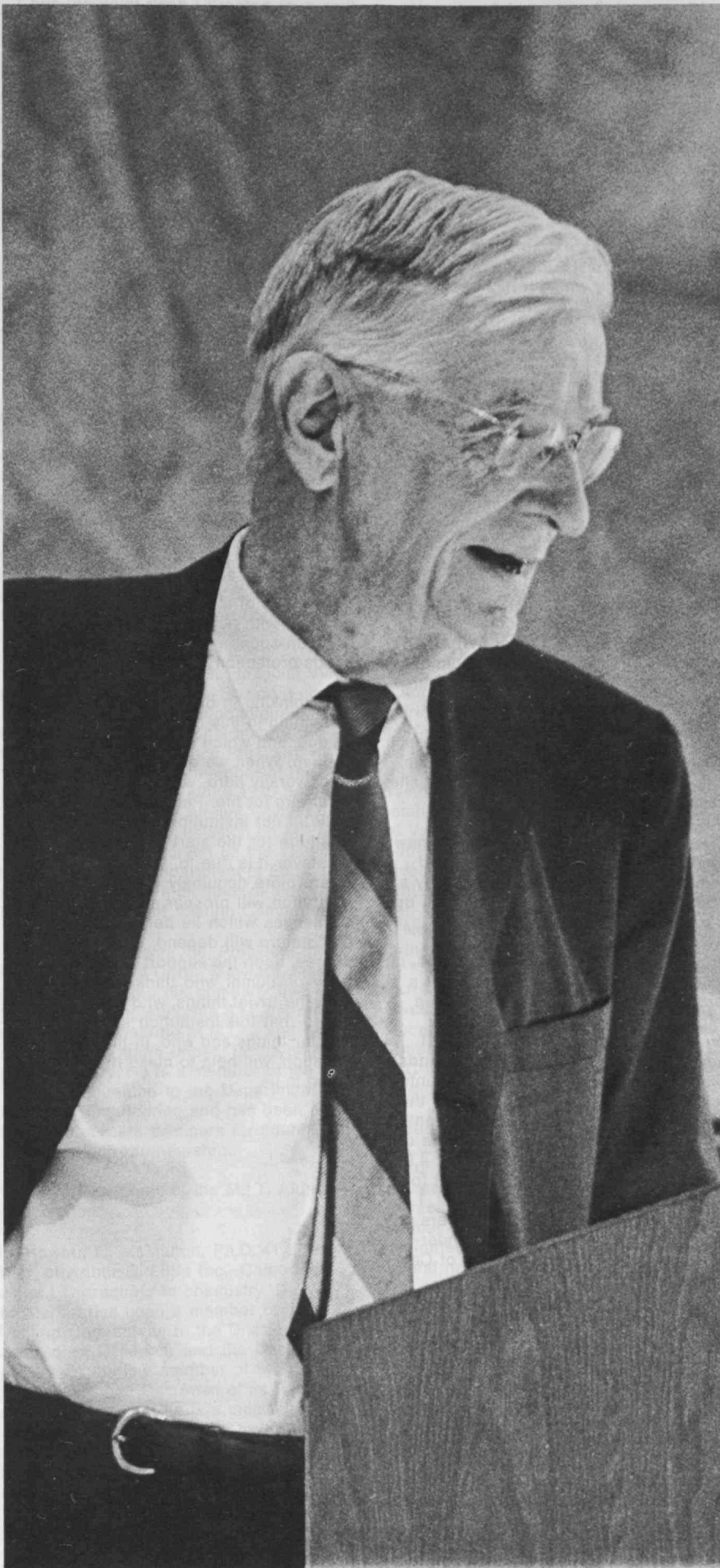
During the 1930's this country came very close indeed to collapse. Twenty million men were out of work or on short time. Some were selling apples in the streets. Business was confused and discouraged and going nowhere. The financial system throughout the world was in confusion. One panacea after another was tried and merely added to the alphabetical bureaucracy. The years passed, and there seemed to be no way out. Life savings were destroyed. Men fought for garbage as it was put out from restaurants. No revolution occurred, but that was only because there was no organization to further it and no inflamed leader to direct it.

Now let us turn to the last great war. We nearly lost it to the submarine. It has been said, with some reason, that we did not win the war; Hitler lost it. But let us examine just one point, which is seldom discussed. Suppose Hitler had developed an atomic bomb before we did. At the time many thought this possible. It did not happen, and one reason was Hitler's stupidity. But suppose he had. Washington, London, and Moscow would soon have been rubble. We would now be living in a very different world; democracy would have vanished not to return for generations. It was as close as that.

If we are in trouble, even recent history gives us perspective; we have seen far worse.

## The Inevitability of Change

How about the universities in this kind of mixed-up world? What is going to happen? They are going to change, of course. Ever since universities were established they have been in a state of change.



*"We have something in this country which is unique, and which we should always cherish. When we graduate from college or university here, we become allied with its affairs for life. One of (the reasons for confidence in the future of M.I.T.) is the spirit, interest, and competence of its body of alumni."—Vannevar Bush, '16, at the 1970 M.I.T. Alumni Officers' Conference. (Photo: Donald L. Estes, '71)*

For one thing the relations between trustees, administration, faculty, student body, alumni are going to change. Not as much in the private colleges as in the enormous state universities, where political factors are bound to enter. Not as much as M.I.T., for here the relations have long been in healthy condition. But change will occur here—as everywhere—because the modern generation of students wishes to take a greater part in the university. I see ahead a greater participation in affairs by the student body, and I welcome it, for the student of today is far better informed, far more mature in that sense, than in my day.

Of course I am not talking about the gang that yells to get on television or the crowd that wants to destroy something to gain notoriety. I am not even talking about the idealist who has false hopes about how best—and far—to advance just causes. And he has just causes. I am talking about the solid group. The students of today are far better informed than they were in my day—or most of yours. In that sense, at least, they are far more mature. When our campuses have returned to sanity—and I think they are doing so now—I think it will help to bring the students more into the affairs of the university than has been traditional.

Let me also say—and at once—that at M.I.T. as long as I have known it the relations of the students to the faculty and the relations of the faculty to the administration and to the Corporation have been on a better basis than I have seen at any other college or university in this country.

Another change is inevitable. Today about half of our youth of college age are in college. What are they going to do when they graduate? Either we are going to see a sharp decrease in the number of youth who are enrolled in college, and in the number of colleges, or we are going to see a large body of young people graduated and thereafter discouraged and disillusioned because they will not find for themselves a proper place—in their eyes, or in their parents' eyes—in society; or else we are going to gain a different concept from the traditional of the function of the college or the university in our midst.



There are, or should be, two objectives of a college education. One is to prepare a youth to be of genuine service to his country and to society, and in doing so to achieve a proper reward, to live as a professional man. The other is to equip a young person so that after he graduates he will enjoy his life in whatever position he may be placed, whatever may be his station; he must learn to appreciate, adhere to, and pursue some of the finer things in life. This latter is to be sharply distinguished from indoctrinating him into the mysteries and shibboleths which will ensure him entrance into some special class in society, an objective which I fear is only too often the incentive—on his part as his parents'—which took him to college in the first place.

If we are to continue to enroll half of our youth in colleges and universities, it will be well to look hard at our objectives and to include among them preparation for enjoyment of life by an individual, wherever he may become placed in our professional and economic structure. When we have half our men of college age in college, something more than has happened in the last two generations must occur in the universities or the universities in this country simply will not have met their opportunities. Though we cannot except M.I.T. from this problem, one of the most satisfying things I have witnessed in the last 20 years has been the recognition on the part of administration, faculty, students, and alumni of M.I.T. of the need to be alert to the responsibility and possibilities for this second, very important aspect of the education we provide.

#### **Troubled—but not Desperate—Times**

What lies ahead for M.I.T.? I see difficulties, and I know there are going to be changes; I know that the financial problems are going to be great. I know that there have got to be some adjustments between students, faculty, alumni, and administration if the whole machinery is to run smoothly. I know that M.I.T., the greatest institution of its kind by far in the world, is trying to do a very difficult thing: it is trying to preserve its unity which has been its great strength throughout the years. For it is not just a collection of schools; it is one affair. It is today trying to preserve that unity while at the same time it attempts to cover all of the significant and pertinent aspects of engineering, science, architecture, and business administration—and with it the humanities. This is difficult, indeed, and it will be more difficult in the future. And I know that this is going to be one of the great problems in the days ahead.

We see ahead reduced support of research by the federal government. Perhaps we should have expected it. The American people often rush into things with enthusiasm, and then react. They do this even on such subjects as stock prices on the exchanges. The cutbacks will render budgets difficult, at M.I.T. and elsewhere; it already has. If it results in severe reduction of the national effort in

basic research it will be highly regrettable. I do not put this in terms of our leadership in the various branches of science internationally. In fact, I feel that if the competition—the friendly competition—were more intense it would be a good thing. I also realize that a period of great expansion inevitably produces fringe activities of dubious merit, and that cutting these off can lead to better health in preparation for a new advance.

But we have done extraordinarily well in the support of basic science in the last 25 years. On the whole it has been well supported and well conducted. It would be sad if it were now seriously injured. I trust it will not be.

I could go on; there are other difficulties and trials I might discuss. Suffice it to say that these are troubled times; but they are not desperate.

We are bombarded by news of crimes and disorders, in the press and on television, so much saturated with fear and gloom that we are in danger of failing to see the small pleasant things about us, things that can reassure us of the good sense and decency of most of our fellow citizens. Let me recite a couple of incidents to show what I mean. What do I remember about the last two commencements at M.I.T.? Not disorder, for there was none. Just quiet small incidents.

The first occurred when Howard Johnson presented a diploma to a girl graduate, and, to the surprise of the audience, she kissed him.

The second occurred when a chap, newly hooded for the doctorate, descended from the platform and was greeted by a toddler, about two feet high, running up to proudly join his father.

I could give more important incidents, but I like the little ones. I could contrast a sordid gathering of young people in a field to hear rock music, which they turned into an orgy, with the fact that there are hundreds, perhaps thousands, of amateur orchestras about the country, enjoying good music. I could recite that, at our last commencement, a student made a brief speech asking for more of forbearance among men, and that 4,000 in the audience held absolute quiet for a minute in response to his appeal. I could tell of the great work members of our student body are doing for underprivileged youngsters in the city of Cambridge.

But I prefer the little things. For it is the little ways in which men act that most truly reveal character and motivations. And there are plenty about us, if we will but look.

#### **Expressions of Pride and Gratitude**

So I turn to what lies ahead for M.I.T. I see difficulties. I have been with M.I.T. in one way or another ever since it was Boston Tech in crude buildings near Copley Square, and I have always seen difficulties ahead. Are they tougher today

than ever before? I don't think so, and I could recite pages and lines as could many of you.

M.I.T. will proceed on its great task as the outstanding educational institution in the world, founded on a basis of science and its applications. It will do so for many reasons. One of these is the spirit, interest, and competence of its body of alumni.

Am I thinking of financial support? Of course I am, and this is going to be of great importance in the years ahead. But this is far from all I am thinking of.

Do I have in mind the help of alumni in getting good students into M.I.T.? Most certainly, and this is to my mind of primary importance. It may well make the difference between training just men who can make grades, and those who will truly be the leaders of tomorrow.

Political action? Well, we cannot overlook the fact that half of our male population is now going through college, that this is producing a lot of votes, and that no democratic government is likely to defy a bloc of that size. But the relations of M.I.T. with government have always been on sound ground, and it hardly needs protection in that relationship.

I am thinking in broader terms. We have something in this country which is unique, and which we should always cherish. When we graduate from college or university here, we become allied with its affairs for life. Part of this is due to pride in our institution, part is due to gratitude for the start in life it gave us. Whatever it is due to, it exists, and nowhere more genuinely than at M.I.T. This institution will prosper amid the great challenges which lie before it. Its health and stature will depend, to no small degree, upon the support of the loyal body of alumni who think more deeply than the trivial things, who are determined that this institution shall go on to greater things and who, in that determination, will help to make it what it is going to be.

*Vannevar Bush, '16, needs no introduction to an audience of M.I.T. alumni. This article is based on his remarks to the concluding luncheon of the 1970 Alumni Officers' Conference in Cambridge on October 9, 1970.*

## 1971 Alumni Nominations

Paul V. Keyser, Jr., '29, former Executive Vice President and Director of Mobil Oil Corp., has been nominated for a second term as President of the M.I.T. Alumni Association in 1971-72; his name thus leads those on the ballot for the Association's 1971 national election. Ballots will be mailed late in March and will be due for return during April.

Among other choices of the Association's National Nominating Committee whose names will appear on the ballot include:

For Alumni Term Members of the M.I.T. Corporation:

◇ Paul M. Cook, '47, President of Raychem Corp., Atherton, Calif. A graduate in chemical engineering, Mr. Cook was a founder of the Warren Wire Co. of Pownal, Vt., and later of Raychem Corp., a developer of wire and cable installations. He has been a member of the Visiting Committee to the Department of Chemical Engineering since 1970; he is a member of the San Francisco Alumni Fund Area Council, and he has been active in other Alumni Fund work in the San Francisco area.

◇ William S. Edgerly, '49, Financial Vice President of Cabot Corp., Boston. Long active in Alumni Association affairs, Mr. Edgerly has served as Chairman of the Club Advisory Board, Vice President of the Association, and a member of the Executive Committee; since 1970 he has been Chairman of the Alumni Advisory Committee to the Commission on M.I.T. Education. He has served on the Visiting Committee to the Department of Economics and now is a member of the Medical Department Visiting Committee.

◇ Kenneth H. Olson, '50, President of Digital Equipment Corp., Maynard, Mass. Mr. Olson founded his company five years after completing his S.M. degree in electrical engineering at M.I.T., and it has since made a major impact in the computer industry. He is a member of the Visiting Committee to the Department of Electrical Engineering and has been active in the recent seminars for young alumni on entrepreneurship.

For Vice Presidents of the M.I.T. Alumni Association:

◇ Howard O. McMahon, Ph.D.'41, President of Arthur D. Little Inc., Cambridge. An M.I.T. graduate in chemistry, Dr. McMahon has been a member of the Visiting Committees to the Division of Sponsored Research and the Department of Biology; he is a member of the Alumni Fund Board and Chairman of its Research Committee; he is a member of the Alumni Advisory Committee to the Commission on M.I.T. Education; and he has been active in recent Association Nominating Committees.

◇ Glenn P. Strehle, '58, Vice President of Colonial Management Associates, Inc., Boston. President of the M.I.T. Club

of Boston in 1967-68, Mr. Strehle has served on committees and in Alumni Fund assignments ever since graduating from the Sloan School of Management (S.M.'60), following which he was on the staff of the M.I.T. Student Aid Center and Athletic Department for two years.

For members of the Alumni Association Board of Directors:

◇ Franklin E. Penn, '40, Assistant to the President—Agricultural Division—and Director of National Bulk Carriers, Inc. Mr. Penn has been a member of the Visiting Committees to the Departments of Nutrition and Food Science and of Naval Architecture and Marine Engineering; he is an Educational Counselor; and he is a member of the Corporation Development Committee and the Alumni Fund Board.

◇ Goff Smith, S.M.'53, President and Chief Operating Officer, Amsted Industries, Inc., Chicago. A Sloan Fellow at M.I.T., Mr. Smith attended the University of Michigan (B.S.E. and M.B.A. 1939) and joined Amsted Industries in 1946; he is a former President of the Society of Sloan Fellows, a member of the Corporation Development Committee, and Chairman of the Chicago Area Alumni Fund Council.

◇ Angel A. del Valle, '43, President of Rodriguez and del Valle, Inc., San Juan, Puerto Rico. Mr. del Valle has been active in the M.I.T. Club of Puerto Rico since 1951 as Director, Secretary, Vice President, and President, and he is a member of the Educational Council. Mr. del Valle graduated from M.I.T. in mechanical engineering, and his firm is involved in a variety of engineering assignments for new Puerto Rican industry.

◇ Norman B. Champ, Jr., '50, of Champ Spring Co., St. Louis. A member of the M.I.T. Club of St. Louis, Mr. Champ has been its Secretary and President and now serves on its Board of Directors. He is an Educational Counselor and has been a member of the Association's Committee for Constitution and By-Laws during the current year.

◇ George M. Keller, Jr., '48, Vice President and Director of Standard Oil Co. of California—the firm he joined as a design engineer upon graduation from M.I.T. in chemical engineering. Mr. Keller is a member of the Corporation Development Committee and of the Educational Council, and he has been active in the M.I.T. Club of Northern California and in Alumni Fund activities.

For vacancies on the National Nominating Committee for 1971-72:

District 3: S. Martin Billett, '48, Assistant Director of Research, Fram Corp., East Providence, R.I.; and Peter L. Quattrochi, '44, Director of Management Services, Inc., Warwick, R.I.

District 8: Ellis C. Littmann, '33, President of Nixdorff-Klein Manufacturing Co., St. Louis; and Armando Santacruz-Baca, S.M.'54, General Manager of Vinilos



P. V. Keyser, Jr., '29



K. H. Olson, '50



W. S. Edgerly, '49



H. O. McMahon, Ph.D.'41



G. P. Strehle, '58



G. Smith, S.M.'53



G. M. Keller, Jr., '48



P. M. Cook, '47



A. A. del Valle, '43

Romay, S.A., Mexico City.  
District 9: Clifford E. Moffet, '41, President of CFM Co., San Francisco; and William H. MacCallum, '24, formerly Executive Vice President of Modern Talking Picture Service, Inc., Los Angeles, Calif.





Joseph H. Greenberg '40  
Robert W. Blake '41



James E. Turney, Jr. S.M. '64  
C. Arnold Kalman '41



John R. Buta '62



Hamilton Herman '43

## International Studies Director

Everett E. Hagen, Professor of Economics and of Political Science who has been Acting Director of the Center for International Studies since shortly after the death of Max F. Millikan, Professor of Economics, last February, has been named Director of the Center.

A specialist in the economic and social development of emerging nations, Professor Hagen has been a senior staff member at the Center since coming to M.I.T. in 1953 as Visiting Professor of Economics. Earlier he had been associated with the National Resources Planning Board, the Office of War Mobilization and Reconversion, and the U.S. Economic Cooperation Administration before taking an academic post at the University of Illinois. He has served as an economic adviser in Burma and—for two years on leave from M.I.T.—as a guest of the Tavistock Institute of Human Relations in London.

## Individuals Noteworthy

To Reverend **George T. Swallow**, '48, a fellowship from the Ford Foundation . . . To **Chi-Yuan Lin**, S.M. '66, and to **Ralph L. Knowles**, M.A.R.'59, teaching awards from the University of Southern California . . . To **Winthrop M. Leeds**, S.M.'39, the Lamme Medal of the Institute of Electrical and Electronics Engineers . . . To **Charles Stark Draper**, '26, the Charles F. Kettering Award from the Patent, Trademark and Copyright Research Institute of George Washington University . . . To **Paul D. Goldstein**, '67, the Lange Medical Publications Book Award at Washington University School of Medicine . . . To **Charles A. Thomas**, S.M.'24, former president, Monsanto Co., the "Distinguished Alumni in Science" Citation, from Transylvania University, Lexington, Ky. . . . To **Martin J. Buerger**, '24, M.I.T. Professor Emeritus, the Fankuchen Memorial Award of the American Crystallographic Association . . . To **Daniel S. Kemp**, Associate Professor of Chemistry, M.I.T., a Teacher-Scholar Grant, from the Camille and Henry Dreyfus Foundation, Inc. . . . To **Noam Chomsky**, M.I.T. Professor of Linguistics, the Sigma Xi Club Sister Ann B. Grady Award at Emmanuel College . . . To

**Bruno B. Rossi**, M.I.T. Institute Professor Emeritus of Physics, the 1970 Gold Medal of the Italian Physical Society.

**Kenneth A. Roe**, '41, President of Burns and Roe, Inc., to President of the American Society of Mechanical Engineers . . . **George P. Palo**, '28, retired chief engineer of Tennessee Valley Authority, to President of the Tau Beta Phi Association, national engineering honor society . . . **Robert H. Marks**, '46, to Associate Director for publishing and information activities, American Institute of Physics . . . **Henry A. Hill**, Ph.D.'42, to Regional Director—northeast; and **John C. Sheehan**, M.I.T. Professor of Chemistry, to Director-at-large, American Chemical Society . . . **Altheastan F. Spilhaus, Jr.**, '59, Assistant Executive Director, American Geophysical Union, to Executive Director . . . **Joseph H. Greenberg**, '40, Principal, A. T. Kearney & Co., to Fellow, American Society for Metals . . . **Stewart A. Washburn**, '44 Vice President, Porter Henry & Co., to member, Institute of Management Consultants.

M.I.T. appointments: **Edward A. Mason**, Sc.D.'50, to Professor and Head of Department of Nuclear Engineering . . . **Walter L. Koltun**, '48, to Assistant Director for Resources, Harvard-M.I.T. Program in Health Sciences and Technology . . . **Herman P. Meissner**, '29, to Lamont Du Pont Professor of Chemical Engineering and Executive Officer of Department of Chemical Engineering . . . **Wallace M. Manheimer**, '63, to Assistant Professor in Department of Physics . . . **Dean A. Horn**, N.E.'49, to Executive Officer, Sea Grant Project Office.

**James Wei**, Sc.D.'55, to Allan Colburn Professor of Chemical Engineering, University of Delaware . . . **Joseph H. Stafford**, M.I.T. Professor of Civil Engineering, to Assistant Dean of Academic Affairs, University of Florida . . . **William H. Denen**, '42, Chairman of Geology Department, to Acting Dean, Graduate School, University of Kentucky . . . **Richard I. Mateles**, '56, to Visiting Professor of Applied Microbiology, Hebrew University, Jerusalem.

**Herbert H. Richardson**, '53, M.I.T. Professor of Mechanical Engineering, to Chief Scientist, U.S. Department of Transporta-

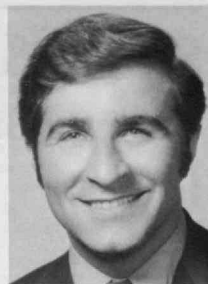
tion . . . **Raymond J. Waldmann**, '60, to Staff Assistant to the President for Domestic Policy Planning . . . **Robert Stuart**, S.E.'59, Chairman of the National Council on Crime and Delinquency . . . **Harry E. Essley**, '36, to serve as Chief of Medical Maintenance, on the hospital ship S.S. *HOPE* on its ten-month teaching mission to the West Indies.

**Francis J. Patti**, S.M.'54, to Manager—nuclear analysis, Burns and Roe, Inc. . . . **Eric S. Beckjord**, S.M.'56, to Vice President, Westinghouse Electric Nuclear Energy Systems Europe . . . **Robert W. Blake**, '41, to Staff Vice President—operations planning, Pan American World Airways . . . **James E. Turney, Jr.**, S.M.'64, to General Manager, Information Systems Division, Technicolor, Inc. . . . **Joseph F. Alibrandi**, '52, to President and Chief Operating Officer, Whittaker Corp. . . . **Walter S. Bertaux**, '48, to General Manager, TF 39 Department, Military Engine Division, General Electric Co.'s Aircraft Engine Group . . . **Robert S. Slott**, '58, to Director—plastics and resins technical center, Shell Chemical Co. . . . **John F. Wing**, '55, to Vice President, Booz, Allen Applied Research, Inc. . . . **E. K. Matthews**, '52, to President, E.P.G. Computer Services, Inc. . . . **Richard E. Lang**, '49, to Consulting Scientist, Computer Systems Engineering, Inc. . . . **John D. Moomaw**, '34, to Manager—Control and Planning Division, Pigments Dept., E. I. du Pont de Nemours & Co. . . . **David C. Sherrick**, '46, to Vice President—marketing, Versitron, Inc.

**John T. Shutack**, '43, to Senior Vice President, Chicago office; **C. Arnold Kalman**, '41, to Senior Vice President, New York office; **Charles P. Bowen, Jr.**, '35, to Chairman, all of Booz, Allen & Hamilton, Inc. . . . **James G. Terrill Jr.**, '41, to Manager—special projects, environmental systems department, Westinghouse Electric Corp.'s Power Systems Co. . . . **John M. Peterson**, '54, to Administrative Assistant to the President, International B. F. Goodrich Co. . . . **John T. McKenna, Jr.**, '50, to Assistant Vice President, Boston Gas . . . **Harold J. Parmelee**, '60, to Chief Estimating Engineer, Turner Construction Co. . . . **John R. Buta**, '62, to Vice President—engineering, Paxson Machine Co. . . . **Hamilton Herman**, '43, to



Donald L. Merriman '49  
Michael Tikson S.M. '56



George J. Elbaum '59  
Harold F. Plank Ph.D. '50



Senior Vice President—development, American Can Co. . . . **A. Bruce Horton, Jr.**, '46, to Vice President, New Orleans Operations, Bell Aerospace Division of Textron . . . **Marshall J. McGuire**, '42, to Vice President—manufacturing, Moore Drop Forging Co., Inc. . . . **Theodore M. Parker**, S.M.'59, to Head of the System Sciences Dept., The Rand Corp. . . . **Donald L. Merriman**, '49, to President, Buckeye Pipe Line Co. . . . **Russell E. Randall**, '23, to U.S. Advisor, China Airlines . . . **Alfred E. Perlman**, '23, to President, Western Pacific Railroad.

**Stewart A. Bliss**, '55, President of the Kaman Sciences Corp., to board of directors of the Colorado Springs National Bank . . . **Perry W. Nelson**, S.M.'70, to General Manager—manufacturing, Continental Can Company of Canada Ltd. . . . **John F. Dennis**, '51 and **Donald E. Schwinn**, S.M.'59, to Assistant Vice Presidents, Metcalf & Eddy, Inc. . . . **Kermit Greene**, '47, to General Manager, Sherman Division, St. Regis Corp. . . . **Lawrence M. Lyons**, '39, to Vice President—operations, Power Group, Burndy Corp. . . . **Michael Tikson**, S.M.'56, to Manager, Computation Systems Section, Columbus Laboratories of Batelle Memorial Institute . . . **Jack E. Charipar**, S.M.'62, to Vice President—research and engineering, Cummins Engine Co. . . . **Roy W. Brown**, '41 to Manager, Technical Division, Goodyear Atomic Corp. . . . **George J. Elbaum**, '59, to Principal, Planning Research Corp. . . . **Robert E. Benedict**, '44, to President, American Mail Line, Inc.

**Carl A. Bergmann**, '49 to Assistant to the President, American Optical Corp. . . . **William E. Cullinan Jr.**, '30, to Manager, Logan International Airport . . . **David B. McLeod**, '50, to President, International Wagenknecht Co. . . . **Robert D. Peck**, '44, to President, and Chief Executive officer, Cambridge Technology, Inc. . . . **William E. Tucker**, S.M.'42, to President, Caltex Petroleum Corp. . . . **David I. Kosowsky**, Sc.D.'55, to member, Trustee Council, Boston University Medical Center . . . **Roland L. Nagy**, '48, to Manager, Commercial Development Dept., Process Plants Division, Foster Wheeler Corp. . . . **Dudley B. Hartung**, '52, to the board of Xenex Corp. . . . **Nathaniel S. Howe**, S.M.'62, to

President, New Britain Machine Division, Litton Industries . . . **Harold F. Plank** Ph.D.'50, to President, Engineering-Science Associates, Palo Alto.

### Alumni Calendar

**Boston**—March 11, Thursday, 12:15 p.m.—Luncheon Meeting, Aquarium Restaurant, 100 Atlantic Ave. Speaker: Glenn C. Williams, M.I.T. Professor of Chemical Engineering. Topic (Pollution).

—April 8, Thursday, 12:15 p.m.—Luncheon meeting, Aquarium Restaurant. Speaker: Robert W. Simpson, M.I.T. Professor of Aeronautics. Topic: Boston and Air Travel.

**Dallas**—March 15, Monday—Evening honoring James R. Killian, Jr. For information contact Jack C. Page, '48, Booz, Allen & Hamilton, Inc., Republic National Bank Tower, Dallas 75201.

**Long Island**—March 5-6, Friday-Saturday—Ski weekend bus trip, Scotch Valley (near Stamford, Upper Catskills). Overnight at the Scotch Mist Inn. For information contact M.I.T. Alumni Center of New York, 295 Madison Ave., New York 10017.

**Mexico City**—March 11-13, Thursday-Saturday—Twenty-third Annual M.I.T. Fiesta in Mexico, honoring James R. Killian, Jr., '26.

**New York**—March 30, Tuesday, 8:00 p.m.—Concert, Haydn's "The Seasons", Alice Tully Hall, Lincoln Center. First of three concerts in a festival of music honoring James R. Killian, Jr. Performed by the Douglass College Choir of Rutgers University joined by the M.I.T. Glee Club, conducted by Klaus Liepmann.

—April 19, Monday—reception honoring Dr. and Mrs. James R. Killian, Jr. Cocktails and buffet supper, 6:00-8:00 p.m., Grand Ballroom, Park Sheraton Hotel. Performance, M.I.T. Symphony Orchestra, 8:30 p.m., Carnegie Hall. At concert's intermission, a presentation of the Silver Stein by Julius A. Stratton, '23, President Emeritus M.I.T.

**San Francisco**—April 23, Friday—Cocktail reception honoring James R. Killian, Jr. For information contact Charles K.

Holmes, Jr. '49, Coca Cola Bottling Co., Fox Plaza, San Francisco, Calif. 94102.

### Deceased

Luther B. Conant, '95, January 11, 1971\*  
Arthur C. Nash, '96, September 25, 1969\*  
William G. Holford, '01, September 15, 1970  
Arthur B. Allen, '03, October 12, 1967  
James W. Kellogg, '10, October 27, 1969  
Roy A. Seaton, '11, May 23, 1970  
Harvey A. Sweetser, '11, January 11, 1971  
Joseph H. Cohen, '13, December 30, 1970  
Scott W. Orr, '13, January 5, 1971  
Frederick O. Stillman, '13, January 13, 1971  
James T. Holmes, '14, December 11, 1970  
Edward W. Larkin, '14, November 10, 1970  
John C. Platt, '17, September 5, 1969  
William F. Saunders, Jr., '19, November 4, 1969  
Wilfred B. Sylvester, '21, July 27, 1967  
Eric F. Hodgins, '22, January 7, 1971\*  
Peter T. Lamont, '22, November 25, 1970\*  
Edward A. Larnier, '22, December 30, 1970  
Austin M. Hill, '23, May 5, 1970  
Herbert H. Engemann, '24, October 16, 1970  
Henry B. Kane, '24, February 11, 1971\*  
Nelson H. Defoe, '25, December 5, 1970  
Carl R. Mabley, '25, November 26, 1970\*  
Natale Gada, '26, April 22, 1970  
Neil W. Perdew, '26, November 5, 1970  
Wesley H. Reynolds, '29, December 19, 1970  
George L. Todd, '29, October 18, 1968  
Mary E. Forsberg, '30, January 12, 1971  
Paul H. Doleman, '31, January 8, 1971  
Carl A. Ekwall, '33, June 30, 1970  
William E. Ward, '33, February 9, 1970  
Wilbur M. Jones, '34, September 11, 1969  
Charles L. Wright, Jr., '34, January 7, 1971  
Robert E. Hadley, '38, December 12, 1970  
Alois V. Menschik, '40, June 26, 1970  
George E. Leavitt, '42, January 21, 1964  
Mark J. Haines, '45, November 6, 1970  
W. Raymond Evans, '46, June 22, 1967  
Joseph B. Quigley, '49, December 29, 1970  
John S. Eversole, '50, November 7, 1970  
Robert F. Tighe, '63, April 1970

\* Further information in Class Review



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# Class Review

## 94

The editors are pleased to share with you these reflections received recently from **Charles G. Abbot**. "I greatly enjoyed and profited by my course at M.I.T. Everything I learned there has been valuable to me. I was so fortunate as to be recommended by Professor Charles Cross to Secretary Langley of the Smithsonian Institution. All my life work has grown out of Langley's remarkable guidance, and the connections I made with G. E. Hale, and Mount Wilson Observatory." Dr. Abbot's long career with the Smithsonian Institution was reported in the January, 1971, issue.

## 95

Our congratulations to Charles Greeley Abbot of the Class of 1894.

We are sorry to report the death of **Luther Conant** on January 11, 1971. He was 98. After graduating, Luther pursued a career in journalism with the *Journal of Commerce* and the *Wall Street Journal*. In 1909 he became deputy commissioner of corporations and in 1912 President Taft appointed him commissioner. He served for many years with the National Industrial Conference Board and was the author of "A Critical Analysis of Industrial Pension Systems." Luther is survived by his son, two grandchildren and four great-grandchildren.—**Andrew D. Fuller**, Secretary, 1284 Beacon St., Brookline, Mass. 02146

## 96

Just recently we learned of the death of **Arthur Cleveland Nash**, on September 25, 1969 at the age of 97. He was born in Geneva, New York, the son of Professor F. C. Nash and prepared for college at Phillips Exeter Academy. In 1894 he received an A.B. degree in architecture, cum laude, from Harvard and then joined the class of '96 at M.I.T. as a member of Course IV. He later spent several years in Paris at Ecole des Beaux-arts, from which he received a diploma in architecture. After two years as an assistant professor at Cornell he opened an office

in New York and practiced there for 20 years.

In 1922 he went to Durham, N.C., as a member of the firm of Atwood & Nash and designed many of the new buildings at the University of North Carolina. He was a consultant to the university during the thirties and forties, when he had an office in Washington, D.C. In appreciation and recognition of his work the University awarded him an honorary degree in 1954. Recently he had made his home in Baltimore with his son-in-law and daughter, Mr. and Mrs. Edward E. Clackwell. Mr. Nash had been a member of the American Institute of Architects.—**Clare Driscoll**, Acting Secretary, 800 4th St., S.W., Washington, D.C. 20024

## 98

About a year ago in the spring **Bob Lacy** had two operations; he wrote to me in November saying that he is well again and has regained his weight. He would like to see **Lyman Hewins**, who also lives in Baltimore, Md., but he is "swamped with mail." I suppose his many friends there and those of Squirrel Island, Maine, sent him their best wishes during his recuperation. We are happy about it, too! For the winter addresses in Baltimore of both these classmates, see the February issue.

The mailman at home is very good about forwarding mail to us here in Mexico. My husband and I are again following the sun with our trailer, this time seeing the fabulous coast. We will return to Springfield, Mass., at the end of May—after a couple of months in Florida. On the way we stopped at Eisenhower Center in Kansas; Colorado Springs where friends showed us the area; Mesa Verde Cliff dwellings; the north rim of the Grand Canyon (saw the south rim in 1965); and visited my stepmother, aged 91, in Arizona. We crossed the border at Nogales and as we went down the west coast, the Pacific beaches stretched for miles, some with heavy surf. In case you have a Mexican map, here are some of the shore towns we visited: Kino, Guaymas, San Carlos, Topolobampo, Mazatlan, San Blas, Puerto Vallarta (did not see

Liz and Dick Burton), Barre de Navidad, Manzanillo, Cuyutlan and Acapulco. At Juchitan we crossed to the east coast of Mexico, visiting Vera Cruz, Tuxpan and Tampico. Never thought I'd get to the tropics! The water temperature is 84 degrees, beautiful scenery: flowers, royal palms in the jungles, mountains on the west coast, dwellings made of palm fronds, waving amigos. Adios, dear friends, until next month.—**Mrs. Audrey Jones Jones**, 232 Fountain St., Springfield, Mass. 01108

## 03

An historic note of particular interest pertaining to our much endeared Professor Arlo Bates, whose unique personality enhanced our English classics course, has recently been reported in the news. Katherine Lee Bates, also a Professor of English Literature at Wellesley College for many years, and devoted sister of Professor Arlo Bates, was author of the immortal song, "America the Beautiful."

In keeping with the desire for preservation for posterity of notable homes today, a Somerville resident, Edward J. Sherry, inspired by the song, has purchased the family birthplace of Professor Arlo and Katherine Lee Bates, to be an historic site in Falmouth, Mass.

Our energetic classmate, Professor Emeritus **Audrey A. Potter** of Purdue University throughout his approaching 89 active years, has evidently found time to enjoy Masonic Friendship. Audrey joined the Lafayette a loisir Masonic Lodge while living in Kansas in 1915 and the Scottish Rite in 1917. Upon entering his long career at Purdue University in 1920 as Dean of the Engineering Department, he moved his Scottish Rite membership to Indianapolis, Ind. in 1922 and received the 33d degree in 1946 at Pittsburgh, Pa.

On December 4, 1970, at the Indianapolis Scottish Rites Convocation banquet, attended by more than 1800 men, Audrey was caught completely by surprise at its close with the speech of Grand Master Richard E. Hickam, and presentation of the Grand Lodge's high-





A. A. Potter, '03

est award, the Caleb B. Smith Medal of Honor. Professor Potter is the 12th man to receive this honor which is given only on unanimous nomination by the Grand Lodge Committee on awards.

The citation which accompanied the medal says: "Dr. Potter, Dean of Engineering at Purdue for 33 years, has served his state and nation in numerous scientific capacities as educator, writer, research director and special consultant. As a mason, he has exemplified the noblest attributes of that fraternity."

**Robert W. Daniels**, Course II, has a new address: Braeburn C.C., Newton, Mass. 02165.

**Louis B. Rapp**, Course III, left the ranks of our remaining classmates on August 31, 1970, at Gainesville, Fla. There is no further information.—**John J. A. Nolan**, Secretary-Treasurer, 13 Linden Ave., Somerville, Mass. 02143

## 04

Another one of our classmates has been doing some traveling lately. **George Kaiser** and his daughter recently visited Europe. I will quote from a letter I received at Christmas. "I recently returned from a delightful two and one-half months trip to Genoa and by car along the Italian and French Riviera, Madrid and other cities in Spain and return by way of Lisbon and Algeciras, Spain.

The most unusual of many interesting sights in Spain was an eighth century Arab mosque in Cordoba. It has 850 marble columns with corresponding Movrieh arches. In the midst of the mosque a 16th century cathedral with tower has been erected, replacing a corresponding number of arches and columns. In Segovia there is a well preserved Roman aqueduct half a mile long still supplying water to the city. In Merida the amphitheater is reputed to be the best preserved in Europe. It dates from the first century B.C."

Our Florida Vice President, **Maynard Halcombe**, is not traveling out of the state at present. He sent me a picture of he and his wife Martha lounging in comfortable chairs beside a swimming pool at his son's home in Naples. He stated that they are feeling fine and playing 9 holes of golf nearly every day. They look very well. That's Youth! Who mentioned shoveling snow.

Word has been received of the passing of **Leyland Whipple**. Details later.

Keep the news coming. It makes very interesting reading.—**E. H. Russell, Jr.**, Secretary, 82 Stevens Rd., Needham, Mass. 02192

## 05

When I wrote the news for the February issue of the *Review*, I neglected a news story from Peg and **Bill Ball**, dated November 25, 1970. Apologies to them. It has since come to light. They are really moving about. At Orange City, Fla., they found Hazel and **Warren Wells**.

Warren pulled out some pictures of the early days at M.I.T., allowing a bit of reminiscing. Later Hazel and Warren visited Peg and Bill at Bradenton. All four are reported to be in good health and spirits. Peg and Bill attended the regular fall dinner of the Southwest M.I.T. Florida Club. The speaker spoke on the subject, "How to get a college degree on your own terms." Bill's reaction, "Times have sure changed." They promise to get back to New England in August of this year, which is two months late to attend our 66th reunion.

Isabel and **Charlie Smart** report "pretty good health." Charlie is still curator of the Gurley Museum, with 165 American-made surveying instruments. Isabel does part-time secretarial work at Russell Sage College, "putting on two large annual teas for Teacher Education Department." . . . **Herman Eisele** writes, "I am still rambling around alone in the same apartment where Mama and I lived for 15 years. I have a good housekeeper who comes one day per week to take care of those household chores for which I never had any affection or talent. Although I can no longer see to drive, I still go to my office in the Engineers Building, by bus, five days a week where I do a little professional work and take

care of numerous personal matters. At 88, I have many limitations, but my health is still fairly good, thanks to the careful supervision and control of eight medical specialists whom I visit at regular intervals." . . . Herman has just received a citation for his 60-year membership in the Cleveland Rotary Club. He is the only surviving member of the Cleveland Club organized in 1910. At the M.I.T. Conference in Cleveland last spring he was the oldest graduate present.

**Tom Geraghty** writes, "We are both in excellent health; the young lady is 80 and I am 89, very active and get around in good shape. I am operating a Manufacturer's Representative business, which is sizeable and keeps me busy." Their Christmas card carries the usual philosophical verse (Louise's, I infer), and leaves me feeling that 1971 will be the best yet. . . . This will acknowledge appropriate Christmas cards from the following and tell us that they are still interested and active '05ers: Herb Bailey, Harry Charlesworth, Hub and Helen Kenway, Dean and Helen Klahr, Gilbert and Elizabeth Tower; Pat and Anna Sullivan, Tom's River, N.J.; Isabelle and George Prentiss, Charlie Mayer, Isadore Nye, Bernice and Leonard Cronkhite, Ione and Art Balkam, Henry Buff, Arthur H. Howland, Sam Seaver, Chet and Isabelle Shaw, Warren and Hazel Wells, Lloyd Buell, Hal Robbins, Grace and Roy Allen, and Bill and Alice Spalding.

**Bill Spalding** says, "Alice and I continue in excellent health; she has just passed her driver's license test at the good old age of 88." Here's hoping, Bill, that she will drive you to New Hampshire this summer. As I write, after a week of sub-zero weather (40° below one night), I re-read Christmas cards—**Charlie Mayer** saying "Enjoying 60° weather here." **Roy Allen** telling about flowers still blooming, etc. I'll be topping them next July. January adds another nonagenarian to our list. **Jim Barnes** entered that charmed circle on January 26. I cannot tell you anything else about him as I have had no answers since he moved to Chicago.

To those who write "I never read anything in the *Review* except Class Notes," let me suggest that you turn to pages 100-101 in the January *Review* and see what added honors have come to Doc Lewis. As a matter of fact, the *Review* furnishes the only news we get about Doc. Not quite so though, for his brother-in-law, **Hub Kenway**, keeps me posted on Doc. Incidentally, Hub and Helen are in reasonably good health (considering). Hub still gets to his office quite regularly. . . . **Gilbert Tower**, who incidentally will have had his 85th birthday (youngest in the class) by the time you read this, asked me whether I would like a (used) copy of LeGrand Cannon, Jr.'s, book *Look to the Mountain*, as he thought it might refer to some of the territory around here. Indeed I would, for I pass over every day the trail Whit and Melissa probably took

on the trail from Squam Lake to Tamworth. As a matter of fact, I look to the mountain from my front window several times a day. I am sure that if the mountains of snow we have had so far this winter do not wash them away, I can show you the footprints where they stepped out of the canoe in Sandwich Harbor.

One change of address: Gilman B. Joslin, Florida Manor, 830 W. Michigan, Orlando, Fla. 32805.—**Fred W. Goldthwait**, Secretary-Treasurer, Box 32, Center Sandwich, N.H. 03227; **Wm. G. Ball**, Assistant Secretary, 6311 Fordham Pl., Bayshore Gardens, Bradenton, Fla. 33505

## 06

Thanks again for the Christmas cards and especially for the notes on them. **Fay Libbey** said he was not doing anything important—"unless keeping myself in condition to plod along is important." He had talked with **Henry Mears** and **Bob Cushman**, who he thought were in pretty good shape. Thanks Fay, for the card and the note. On his UNICEF card, Henry Mears reported: "The three of us are still here and able to eat and get around, although we are not so active as to see much of each other. Fay and I just wish each other Merry Christmas and drink our own mixture to each others health." On a card from **Jim Wick, Jr.**, he added "The same old Wish" which was also the message from Betty and **Stew Coey**. If you would like to drop a line to our Class President the address is Box 67, Newbury, Vt.

The card from the **Johnson O'Connors** showed the beautiful interior of the theatre in Venezia where, Eleanor said, they had seen LaBoheme last summer. Other cards were from Walter Davol, Leavitt Bent, Agnes Coe, Mary and Harry Fletcher, Robert and Anne Rose, Dr. Gene and Lynne Fogg, John and Margaret Norton. Jack says he is getting to be a good house maid and food shopper. Like the rest of us!

The January notes contained a report of the death of **Henry Hubbell**, with his business career. Early in January Bertha Chase received a letter from his widow—Katherine Walker Hubbell—which she acknowledged and sent to me. I have also sent a note of sympathy and thanks to Mrs. Hubbell. It was in 1917 that Henry joined the United Shoe Machinery Co., becoming in 1938 the Vice President in charge of manufacturing in the U.S.A. and Canada. In Conway, N.H., he was on the Board of Directors of the Carroll County Trust Co. for over 40 years. They were married in 1920 and have three children: Katharine (Kay) who lives with her mother in Conway and has been a nationally ranked tennis player; Henry, Jr., who is with the F.A.A. in Washington; and Thomas W. who is with Eastman Kodak. Henry had been ill for several years and was 86 when he died on August 8, 1970.

**Otto Bernard Blackwell**, Course VI, S.B., was born on August 21, 1884, in the town of Bourne, Mass., and died November 26, 1970, on Long Island. He prepared at Bourne High School; Otto was a member of the E.E. Society; his thesis was on Enclosed Fuses. All of Otto's business life was with A.T. & T., the first few years in Boston and there after in New York City, becoming Director of Transmission Development and by 1940 a Vice President of Bell Telephone Labs. By November, 1947, he was Assistant vice president of A.T. & T., retiring I think, by 1949 to live in Plandome, L.I., eventually in a retirement home. We were informed of his death by his wife, Elsie Eldredge, who lives with a married daughter in Plandome.

**Edmund Kent Lawrence**, A.B. Course I, was born April 21, 1884, in Baltimore, where he died on April 28, 1970. He had earned his AB degree at Rockhill College before joining our class in the sophomore year, becoming a member of the E.E. Society. His entire career was with the B & O RR in Baltimore.

**Charles Greely Loring**, Course IV S.B. (AB Harvard), was born October 23, 1881, in Prides Crossing, Mass., and died September 3, 1966. Although his primary interests were with Harvard, Charles was active while with us during our last three years. He was a member of the sophomore football team, was President of the Walker Club, and on the Executive Committee of the Architectural Society Annual. His thesis was "A Private Hospital." Following graduation he studied for a year or more at the Ecole des Beaux Arts. By 1910 he was associated with Cass Gilbert, Architects, of New York but soon came back to Boston to form the firm of Loring & Leland and continued to practice until he retired, in the early 60s I believe, continuing to live in Concord and then in Lincoln.

**Lawrence Burns Webster**, Course VII S.B., died on October 7, 1969, we learned from the Harvard Alumni Office. We have no record until 1915 when he was an engineer on valuations with the American Gas & Electric Co. in New York City, also engineer for committee on appraisals of the Ohio Electric Light Association. Lawrence later became Assistant to the President, Cleveland Twist Drill Co., and Executive Secretary of the Ohio Manufacturers Association in Columbus.

Thus ends our contribution for this month.—**Edward B. Rowe**, Secretary-Treasurer, 11 Cushing Rd., Wellesley Hills, Mass. 02181

## 08

We have a report from **George D. Whittle**, 2550 Dana St., Berkeley, Calif., a retired consulting engineer who gives a brief outline of his work since graduating as a civil engineer in 1908. His first four years were spent on railroad

construction and maintenance in Texas and California. Then followed three years in the Bridge Department of the California Highway Commission at Sacramento. George then spent 31 years as Bridge Engineer in the San Francisco office of the U.S. Bureau of Public Roads, supervising design and construction of bridges in the four south-western states. In 1918, he became First Lieutenant Engineer at Fort Belvoir, Va. From 1923 to 1941 George served as Captain in the Engineer Reserves; 1949 to 1950 he served as Principal Engineer of the proposed "Parallel Bridge" being planned across San Francisco Bay. During 1946 to 1950 he was also a member of a nationwide group, Advisory Board on Investigation of Long Span Suspension Bridges. From 1950 to 1959 he was consulting engineer on highway structural projects in California.

Several railroad bridges on the Hamakua Coast of Hawaii near Hilo were damaged by the seismic wave of 1946 and the railroad was abandoned. In 1948 he studied and reported on the possible use of undamaged portions of this in a highway replacing the railway. He recommended that they be used, his recommendation was followed and both money and time were saved thereby. He also designed bridges on a 50-mile railroad in Arizona, and solved bridge problems on a proposed highway system in Liberia, West Africa.

A Fellow of the American Society of Civil Engineers and President of its San Francisco Section in 1945, George was a member of the Commonwealth Club of California serving as chairman of its section on highways and transportation for seven years.

We are sorry to report the death of **Frank W. Willey**, of Cincinnati, Ohio, on August 22, 1970. **Joseph W. Wattles**, Secretary, 26 Bullard Rd., Weston, Mass. 02193

## 09

We were most pleased to receive through the Review Office a communication from **Joseph N. Stephenson** (Steve) from whom we have not received any news for some time. As a student he was most active in Class and M.I.T. affairs. We remember him as a runner and a member of the M.I.T. Track Team and as a Y.M.C.A. officer. After graduation Steve devoted a few years to teaching, becoming a professor of chemical engineering at the University of Maine from which he later received an honorary degree. In 1916 he became Editor-in-Chief of the *Pulp and Paper Magazine of Canada*, a National Business Publication periodical, a position which he held until 1966—a period of 50 years which may be a record. During these 50 years he did much to increase the scope and coverage of this magazine. Steve received many honors and citations. All the important ones, we believe, have



been reported in these notes. In 1965 he resigned as Vice President of National Business Publications and Editor-in-Chief and retired to Wolfeboro, N.H., where he had a summer home since 1910. His communication is as follows: "The picture of the trolley car in your December issue (page 55) suggested that it may interest you to know that my grandfather, John Stephenson, built the first streetcar in America, and maybe in the world. It was drawn by two horses and was used to carry passengers in New York between the Hudson River Ferry and the ferry to Brooklyn; I think 23rd Street. This served people traveling between the ferries." Steve's present address is Carroll County Home, Ossipee, N.H.

With regret we report the death of **Kenneth Sargent May** at Newton Highlands, Mass. Services were held on December 26, 1970 at the Newton Cemetery Chapel. Kenneth prepared for the Institute at Newton High School and was in Course VI (Electrical Engineering) at M.I.T. After graduation he was associated with the Boston and Worcester Street Railway, Boston Elevated Railway Company and Stone and Webster before joining Arthur Perry and Company in 1916, of which he later became a partner. During World War II he was executive vice chairman of the Massachusetts War Finance Committee of the U.S. Treasury Department. He joined Whitney, Weeks and Stubbs in 1946 and later joined the F. S. Moseley Company from which he retired in 1963. Kenneth was a director of the Norumbega Council of Boy Scouts, a director of the Newton Community Chest, a trustee of the Newton Highlands Congregational Church, and a member of the Retired Men's Club of Newton. He leaves his wife, Frances (Stevens); two daughters, Mrs. Henry Harwood of Waban and Mrs. John E. Dorer of Florence, S.C., a son, George B. of Amherst; 15 grandchildren and eight great grandchildren.

Your secretary was a close friend of Kenneth while we both were students at Newton High and members of Course VI. He has made frequent contributions to the class notes telling of his family and of his business career. In behalf of the Class and in our own behalf we wrote to Mrs. May expressing our deep sympathy to her and her family. She has replied as follows: "I sincerely thank you for your very nice note of sympathy from yourself and the Class of 1909. I have often heard Kenneth speak of you for he considered you one of his special friends, with the double tie of high school and college. On August 1, an automobile hit him and broke both legs and caused other serious injury. He spent five months in the Newton Hospital and Chetwynde Nursing Home where he made gallant efforts to recover and succeeded in using a walker. The long strain was too much physically and he finally succumbed. It was a sad parting after 57 years of companionship but our three children (George is Comptroller and Assistant

Treasurer of Amherst College) are helping me to carry on."

We have just received from the Alumni Office the notice of the death of **Julius Serra** which occurred in August, 1969, at Staten Island, N.Y. Julius prepared for the Institute at Melrose (Mass.) High School and took Course I (Civil Engineering). His thesis was "Design of a Reinforced Concrete Building." Our records show that with the exception of short residences at Tacoma, Washington and Philadelphia, he lived on Staten Island for most of his life. Many of us recall that he attended Alumni Day very regularly until his failing health prevented it. In late years he would write a note to the secretary apologizing for his inability to attend. So far we have not received any information relating to his employment and his family.—**Chester L. Dawes**, Secretary, Pierce Hall, Harvard University, Cambridge, Mass. 02138; Assistant Secretary, **George Wallis**, Wenham, Mass. 01984

## 11

My first and most important item: Remember our 60th reunion in June and do something about it. In about a month you will get another letter from the Committee enclosing a registration form. Be ready for it.

A Bucknell University news release: "He may be a retired mathematics professor and he is 82 years young, but Dr. **William T. (Mac) MacCreadie** is still going strong in the invention business. Just recently, MacCreadie received official word from the U.S. Patent Office that he is a patent holder of an electronic timing device which he invented for use in judging swimming meets. He holds eight patents for the production of wire rope, and now that his swim judging machine is done, he is talking about working on a device for track.

"Electronic timing devices for competitive swimming are currently on the market, but MacCreadie feels that his machine is different because a computer is used to select the winner. He says 'As soon as a swimmer hits a special mat at the end of the pool, the number of his lane lights up on a panel. There is no waiting for the results to be read from the timers.' The device also is equipped to determine whether swimmers in a relay race leave the starting block too soon.

"MacCreadie, who holds degrees from M.I.T., Harvard and Cornell, has waited five years to get his patent for the timing device. In the meantime, he has been kept busy following Bucknell athletic teams and playing golf with his wife. 'Doc' has had a hole in one on two occasions, the last coming two summers ago, but the most recent 'ace' belongs to his wife, Vera, who achieved the honor the past summer."

On the Sunday before he flew north last

fall, several of his widow neighbors for whom he has done chores gave **Harry Tisdale** a dinner party at La Playa restaurant at Vanderbilt Beach. The car they took him in bore a sign "H. Tisdale and his Harem." Harry has been living alone since his wife died a couple of years ago. He cuts lawns and does other chores for his neighbors.

Brief notes from all over: **Paul Cushman** is teaching mechanics at a university in Oklahoma City and says he is putting in 48 hours a week but will take time off for our reunion. . . . **Robert Morse's** wife does not like a picture I took of him last summer. I sent him a copy anyway. . . . From **Frank Smith** in Honolulu "I'm still alive and kicking. Play shuffle board, read, nap, eat and read again. Then to bed at 10 p.m. . . . **Harold Robinson** thinks that the students who disrupted President Johnson's office last winter should have been jailed and their parents required to pay the damage. . . . From **Joseph N. French**: "Retired in 1967 at age 79; associated with Albert Kahn Associates for 52 and a half years, one of the principal stock owners. Yolander and I will attend June, '71 reunion. We have 6 children, all married, 23 grandchildren and 3 great grandchildren." . . . A year ago **Suren Stevens** spent 10 days in the Massachusetts General Hospital undergoing a major operation, but says everything is O.K. now. . . . **Allston T. Cushing** is looking forward to his 50th wedding anniversary on June 29.

I have two changes in address: **William H. Coburn**, Fisherville Lane, Westport, Mass. 02790 and **D. P. Gaillard**, 627 Barr Bldg., Washington, D.C. 20006. . . . **Harvey Sweetser** of North Quincy, Mass., died January 11.—**Oberlin S. Clark**, Secretary, 50 Leonard Rd., North Weymouth, Mass. 02191

## 12

Do You Remember our monthly "Do you remember" opening paragraph? After three years we have completely exhausted our recollections of various incidents during Tech days with but little help from others. So now it is up to you to finish such information if this feature is to be continued.

**Howard Cather** writes from Rochester, N.Y., "My wife and I liked last year's Florida winter schedule so much that we are repeating it this year. We plan to spend two weeks at Lido Beach, Sarasota in February, followed by a similar period at Vanderbilt Beach, Naples, after which we shall visit with friends on the East Coast. I was interested in your statement in the January *Review* that you were one of 30 class secretaries receiving 'appreciation certificates.' Considering the fact that this represented a period from 1895 to 1970 it seemed that one of 30 was a fine record. Phil Capen, secretary of 1913, and a good friend of mine, writes as follows on this subject, "It was noted

that the older secretaries of 1903 and 1912 should be complimented for their accomplishments of support with their classmates." This would indicate that you were much too modest and that you should properly be rated as one of two. **Anyhow**, congratulations on a superb job, and I mean super." Thank you, Howard. Although I feel that such extravagant praise is hardly warranted with so many other secretaries doing a fine job; I am greatly pleased to receive such a letter. It helps to make the effort worthwhile.

We received a Christmas letter from **Cy Springall** and Marjorie at which time they were entertaining their two-year-old grandson and his mother and dad. Marjorie underwent an operation last fall but has fully recovered. She and Cy are spending the winter as usual in Scottsdale, Ariz. . . . Our loyal contributor, **John Pettingell**, writes, "I greatly enjoy reading your interesting news column. Personally, I have nothing of interest to report. Both of us are fortunately in good health. I keep busy at home and with short auto trips which we both like to take. Best wishes." . . . "**Mac**" **McCormack** advises that he has become a great grandfather with the arrival of a seven and a half pound boy born to his granddaughter in Pittsburgh, Pa. Our congratulations!

We are pleased to hear from **Henry Dunbar** who spent one year with us as a special student in Course I. He worked for many years with Keyes Wearer, Inc., Buffalo, N.Y. His wife, Ellen, writes that for the past seven years, they have wintered in Miami, but due to the much higher costs in that city, they have decided to remain in Virginia this year. They have two children and six grandchildren who live in Miami. Good luck, Henry! We hope that you both are enjoying good health. . . . **L. B. (Shorty) Walker** has recently moved from Bridgeport to Shelton, Conn., at Wesley Heights Community, 500 Long Hill Avenue. . . . **Paul Tyler** writes that he and Katherine spent two weeks last summer with Katherine's son and family in Colorado. Her son has recently become administrator of the Colorado National Monument. They took an interesting nine-hour trip down the boisterous Colorado River in a big rubber boat. After a week in San Francisco, they spent several weeks in the Appalachian Mountains. Both are in good health and Paul says he has just painted his Florida home for the exercise. . . . A letter addressed to **Juan Garza** in Monterrey, Mexico, was returned by the post office with the note, "Insufficient address." Unless some classmate has information regarding this classmate, who was a special student in Course II for three years, we must discontinue our efforts to contact him.

Belatedly, we have received word of the passing of **Bill Lynch** in Beverly Hills, Calif., on August 21, 1970. As stated in the June issue of the *Review*, Jonathan Noyes attempted to visit Bill while in

his vicinity last spring, but his housekeeper informed Jonathan that he was unable to receive visitors. We have no other information but have written the trustee of his estate. Many of us remember Bill who was a loyal alumnus and always attended our reunions.

We arrived in Florida in mid-January and hope to see three or four classmates soon who are living or wintering nearby in the St. Petersburg—Venice district. —**Ray E. Wilson**, Secretary, 304 Park Ave., Swarthmore, Pa. 19081

## 13

Our snowy and cold winter will be over when you read our notes, and we shall be reading seed catalogues and planting instructions. The holidays were very full of good cheer and real friendship. The Capens received many Xmas and New Year cards, including a greeting from the Review Staff; the Brewsters; Charlie Thompson; the Brewers; Ken Blake; the Mattsons; and Mrs. Ethel Gustin; and of course a masterpiece from Kay and Irving McDaniel (Class of 1916).

**Ken Blake** pens: "The reverse side of this card is one of the kind of pictures we take in August. Mt. Shuksan in the new North Cascades National Park. At this moment this spot is under 15 feet of snow. Just beyond the little pond it drops straight down for 2,000 feet. Don't go near the edge." . . . Maurine and **Allen Brewer** add: "Thanks for the nice write-up you gave me, Phil, in *Tech Review*. Bill Brewster has sent me some very interesting Plymouth literature." . . . The **Bill Brewsters** signed their card "Hi, again." . . . **Johnny Welch** writes us his yearly letter and we quote: "It's a great relief and pleasure to send you my class dues with congratulations for your help in keeping inflation down; about the only item I know of like this. I sure would like to have a chance to go to another meeting soon, but my trips East will be few now for Frances and myself, as her sister, who married my brother Bill, died last September, and Will died 6 months earlier. They had a lovely home at West Harwich which they sold and moved to Lexington, where they lived only a short time thereafter. I read the *Tech Review*, and to me it isn't at all pleasant—groups of intellectual professors banding together to pledge not to do any research for our government for any arms, etc. . . . I suppose one cannot question their patriotism, but they don't show good sense. Regarding the long article in the recent issue by another great intellect Prof., when do the students have the time for much beyond their studies? And some outside experiences and maturity would better able them to judge matters of great import, after they had first got their education, or they should go to some other type of college. Another President of a midwest college has a better view and tells the student body definitely to go elsewhere if the courses at his college don't suit them. This has

developed into much more than I understand . . . and deserves more time. But I am sure you know all these things and more; but I am distressed at these and other matters that give me the itch—Fulbright, McGovern, Ted Kennedy etc. We go to Florida in February and forget what we can do little about. Regards and best wishes to you and your wife."

**Fran Achard** is becoming a top-notch correspondent and we quote: "Now it can be told—I am an incurable procrastinator. I find myself faced with numerous Christmas cards. For Christmas I went to Wayland and had dinner with my favorite 'niece by affection', Betsy and her husband, Dave. Betsy's parents were also there. Dave is getting his doctorate in something this June at M.I.T. New Year's eve afternoon found me at a neighbor's toasting the New Year. Jim was in a serious automobile accident about four weeks ago, but is convalescing in great shape. Have you noted the news to close out the Brighton Marine Hospital? A crying shame, I call it. I am writing to Secretary Richardson. For my money, Brighton Marine is the superior hospital in Boston in all important matters. We are gradually getting into shape, and will be ready for shenanigans in June. Happy New Year to one and all."

A note from "Jo" and "Bill" was received as a New Year's greeting and we quote in part: "On November 17 we had a Happy Thanksgiving reunion in California with my nephew and his family. We spent 3 days in Scottsdale with Jim (Bunny) and Garnet Brett. Somehow they missed seeing the article in the *Class* of 13 notes in the *Tech Review* about our visit there last March. Do you have an extra copy or could you get one and have it sent to them? (We sent a copy of our notes—Sec.) We would send our copy, but we gave ours to the Golden Public Library. We hope you both have a Happy New Year filled with good health n' happiness."

We are indebted to Charles Thompson, Azel Mack (Secretary of the Class of 1915), Fred Lehman (Secretary, M.I.T. Alumni Association) and Ira Cohen (Joseph's son), for bringing to our attention the very sad announcement of the passing of our dear friend and classmate, **Joseph H. Cohen**. He was always a loyal Alumnus of M.I.T., and especially to our Class of 1913. To his attractive wife Rose, and Joe's family, we of the Class of 1913 offer our sincere sympathy for the loss of an outstanding American. We quote: "**Joseph H. Cohen** of 180 Beacon St., Boston, died Wednesday, December 30, 1970, after a short illness. He was 80. Mr. Cohen attended English High School. He graduated from M.I.T. in 1913. He designed and constructed an ossein plant in Everett and a glue plant on Spectacle Island in Boston Harbor. Mr. Cohen became vice president of General Foods Corp. in 1930. He was president of the Gelatin Manufacturers Association for 20 years. In 1932 he was elected to the



board of trustees of Temple Israel, where he served as president for 13 years. Under his leadership, the Temple grew from 1,000 to 3,000 families.

He was a member of the board of Beth Israel Hospital. He was a past member of Kernwood Country Club, Salem, and of Belmont Hill Country Club, Belmont. He was a member of the University Club of Boston and a former member of the Standard Club of Chicago. He leaves his wife, Rose (Stone) Cohen; a daughter, Mrs. Jess Silberstein, of Larchmont, N.Y., two sons, Joseph H. and Ira Cohen, of New York City; and nine grandchildren."

A very welcome letter has been received from Mrs. Marjorie Bowman, **Lee Bowman's** widow, so we quote in part: "Thank you for your kind note of sympathy. I am also grateful for the paragraph in the January *Technology Review* regarding my husband. I don't suppose there are many of his class who remember him, but he always liked to hear from those who kept more or less in touch with him: Will Barrows of Braintree, Henry Glidden of Abington, and I think that Lindsley Hall, who passed away a year or so ago, was also in that class at M.I.T. These were the only men I knew of Lee's friends there. Thank you again."

Well, boys and girls of the Class of 1913, are you saving (in your "piggie bank") your pennies in anticipation of our 60th reunion in 1973? Until next month.—**George Philip Capen**, Secretary and Treasurer, **Rosalind R. Capen**, Assistant Secretary, 60 Everett St., Canton, Mass. 02021

## 14

Just a note from **Jim Reber**: "All's well in Houston, Texas." . . . **Bob Townend** writes: "I wrote Herman Affel that William A. Simpson passed away on September 25, 1970, also that Dave Gould died in July but I have no details in the latter case. Also, I attended the Alumni Officers' Conference at M.I.T. in October as I am Honorary Secretary for the Admissions Department." . . . **Fred Karns** notes: "Margaret and I are feeling fine and we are keeping busy. We are planning on a Scandinavian trip in 1971. We would be interested in a 1914 Class Reunion in 1972. Merry Christmas."

Following is a copy of a letter to Dr. Killian regarding the recent death of **Jim Holmes**. "Dear Dr. Killian: It is with deep regret that I must advise you of the death of M.I.T. graduate and Holmes & Narver's Founder and long-time President, Mr. James T. Holmes. Mr. Holmes valued his association with M.I.T. and enjoyed his service on the Corporation Development Committee. His participation was limited only by his personal and business commitments in Los Angeles. Very truly yours, (signed) Dallas Shenk, Former secretary to Mr. Holmes." A publication of Holmes & Narver, Inc., *Here and Now*, with a

special tribute to Mr. Holmes was enclosed.—**Herman A. Affel**, Secretary, Rome, Maine P.O. RFD 2, Oakland, Maine 04963

## 15

A sad loss for our Class—**Al Sampson** died December 16, in a Beverly, Mass., hospital. He had no immediate family so we are unable to report further. It must have been sudden, for a few of us had a gay lunch with him at his house only a short time before that. Al will be remembered as the originator of our slogan "The Class Supreme" and the organizer of our big and successful class cocktail party and dinner on Alumni Day. The M.I.T. Faculty Club, where we hold this, is still using Al's original plan and set-up, which he put forth in great detail. A regular contributor to all Class and Alumni activities and funds, he voluntarily and generously made up the deficit to the Class for this annual Alumni Day show we've had over the years. He was a great and gracious host and a thoroughly reliable worker on any committee. He was retired manager of the National Aniline Division of Allied Chemicals of Boston and an incorporator of the Beverly Savings Bank. Born in Gorham, Maine, he dated his ancestry to Henry Sampson, a passenger on the Mayflower. He was past president of the Beverly Rotary Club, the Beverly Chapter of the American Red Cross, and the Dry Salters Club of New England. He was also former national treasurer and charter member of the American Association of Textile Chemists and Colorists.

Representatives of our Class attended his services in Beverly. Typical of Al's thoughtfulness, all at the service were invited to a "Social Hour" at a nearby Inn. And his humor in having the minister read from the Bible the Passage: Judges 13:24 "And the woman bore a son, and called his name Samson; and the child grew, and the Lord Blessed him." It will be hard to forget Al.

It's sad to report that **Ernie Loveland** died on December 2, in St. Luke's Hospital, New Bedford, Mass. He had finally made it back home to Marion, Mass., but hepatitis, which he had contracted out in the South Pacific became too much for him. We all remember those long, interesting letters he wrote about his exciting, colorful and unusual experiences and contacts out there in his sea-weed research. He had a world of courage and determination and we all admire his spirit and fight. It's a pity he did not make it all the way. The sympathy of our Class goes to his family.

The 52 Christmas cards we received from widely scattered Classmates and their families were a warm reminder that the Joy of Christmas is a good deal in living with the memory of fine old friendships. With his annual poem reviewing the past year, **Phil Alger** wrote, "I hope to attend our 60th reunion in

1975 before making my 10th hospital visit." Glad to see you there, Phil. In a colored print, Helen and **Ken Boynton** are posed in front of the pretty entrance to their Southern Pines, N.C., house. **Earle Brown** threatens to join the many retirees in the Class. Helen and **Otto Hilbert**, Corning, N.Y.: "It looks like Christmas here, but we think we'd rather be walking on a warm beach. We plan to take off for warmer parts after February 1. As always we enjoy your Class notes." Helen and **Boots Malone**: "Since you did not come up to see us in Vermont last summer, maybe you'll stop by in Florida. We have left Sarasota (too much traffic) and moved just north of Eustis, Fla., to Umatilla." **Harry Murphy's** son, Peter and his wife sent a cute picture of their six children arranged on a flight of steps with their childish signatures on the inside of the card. Ironically, **Al Sampson's** card arrived the day he died—a silk print of "The Young Samuel" done in Italy.

**Ray Stringfield**: "Haven't any M.I.T. news for you. Margaret and I have to go to the Rotary Christmas party alone this year. They always have a Santa Claus and want us to bring our children or grandchildren that are 14 or under, and all of ours are too old. One is married to a Goodyear man and now living in Luxembourg, and another is getting married next week in New Mexico. We've just been to Christmas dinners and shows three nights in a row, L.A. Rubber Group, Shrine and Margaret's sorority. Good thing Christmas is only once a year. Best regards and a very merry Christmas to both of you from both of us." . . . We're glad to welcome new comers to our card list this year **Alton Cook**, Florence and **Harvey Daniels** and **Horatio Lamson** and his family. Long distance cards came from Carmela and Gus Gross, 1950, Guayaquil, Ecuador, and Margaret and Gilbert Mar, 1951, Taipei, Taiwan. A card signed by the Editor and his staff at the *Review* made me feel that after all, they really care. Grace and Harold Dodge, the hard working 1916 Secretary, sent an original hand made card. Alice Anderson wrote she had sold their farm and was going to Portugal to visit. She and Herb entertained us royally there for our 25th reunion plans.

Then there were cards from Elizabeth Baker, Alice Chellman, Tess Hilton (who had just had a Martini with Lee and John Homan), Virginia (Thomas) and Paul Johnston, 1921; Vi Proctor (widow of Dix 1917), Janet and Gerry Rooney, May Shells and her family; Margaret Runels and Barbara Thomas. Long may the flames of these fine, old friendships brilliantly burn to light our lives in the future—many thanks and many blessings to you all.

For the old Pirate's 80th birthday on January 3, Ethel Rooney gave him a cocktail party, attended by many Classmates and their families, including Mary Scully and Frank's sisters Genevieve and Florence, and May Shells with Bill

and Jeanette Sheils. He received many cards and greetings from the Class and long distance calls from Hank Marion in Tucson, Arizona and Ben Neal in Lockport, N.Y. It was a gay party and a fine tribute to George. We all thoroughly enjoyed a very gay and happy afternoon.

**Bill Brackett** writes: "I was just looking at the latest reunion picture and suddenly saw a couple of eyes and a nose of some body behind me and Max Woythaler. Apparently it is No. 21, Wallie Pike. What a spot he picked to locate. At least the picture is a conversation piece." . . . **Wayne Bradley's** Moosilauke Inn at Warren, N.H., is all set up for a season of winter sports—skiing, snowmobiles, movies, bingo and what have you around the fireplace. Better try it!

From **Whit Brown**, in Anna Maria (Brandenton), Fla.: "We have a pretty good M.I.T. Club of Southwest Florida, which meets a few times a year in Sarasota; they had a luncheon meeting last Monday with a couple of undergrads who were home for the holidays. One of them had a lot to do with the anti-pollution auto race to Cal Tech, and he showed slides and gave a very interesting commentary along with the slides. A very good job. In the question and answer period, we got an encouraging report on the lack of current demonstrations on campus; he said that President Johnson's handling of the affair a year ago was excellent, and was largely responsible for the quiet that prevails this year. They were enthusiastic about the Institute and what they were getting out of it. That is very encouraging." . . . **Jack Dalton**, Winter Park, Fla: "It really has been unusually good weatherwise since we got here. No rain whatever until a shower last night and clear warm days averaging between 70° and 80°. Too good to last, I'm sure. The main thing here is that we avoid the snow and ice. The cold we could take." Jack and the rest of those "snow birds" down there have escaped one of the worst winters we have had around Boston. Ah, me! To get away from the round of holiday parties, Lucie and **Harry Murphy** left Boston in a snow storm and one and three quarter hours later were sipping rum punches in 70° sunshine in Bermuda. Ah, me! Again! **Ben Neal** and his daughter, Barbara, visited us here for lunch during the holidays. Molly Swift wrote with her Christmas card that Speed had left us all the pictures that had been taken at our Cape Reunions and invited me to go up there in the good weather to get these touches of nostalgia. Remember his famous movie "Help Aze!"?

From West Palm Beach, **Jim Tobey** sends his annual message: "I am suffering here at 80°. Come on, join the sufferers." So, on April 2, when the snow and ice of this miserable winter has changed to warmth and sunshine and the Boston Red Sox are opening their search for this year's pennant, we'll have a Boston Class dinner. Until then,

## Use this Coupon for Reunion Information

Panos D. Spiliakos  
Alumni Association  
Room E19-438, M.I.T.  
Cambridge, Mass. 02139

Tell the Reunion Chairman for my Class that I need information and reservations forms for the 1971 reunion.

(Name)	(Class)
<hr/>	
(Address)	
<hr/>	
	(Zip code)

"help, help—and pay your class dues."—**Azel W. Mack**, Secretary, 100 Memorial Dr., Cambridge, Mass. 02142

## 16

A clipping from a west coast publication forwarded by Joe Barker keeps us posted on one of our active retirees: "**Willard C. Brown**, a resident of Santa Barbara and a former executive of the General Electric Co., Cleveland, Ohio, has received the Distinguished Service Award of the Illuminating Engineering Society at a luncheon in conjunction with the National Technical Conference held in Boston. Brown holds the society's highest award, the I.E.S. Gold Medal, and is a fellow and past president of the society. He is also the author of numerous papers on the subject of illumination. Prior to his retirement in 1960, Brown was affiliated with G.E. in Cleveland as manager of lighting education. He is a licensed professional engineer in the state of Ohio and a past president of the Cleveland Engineering Society. Brown received his B.S. degree from the Virginia Military Institute and was later awarded an honorary degree in electrical engineering from that school. He also holds electrical engineering degrees from Harvard University and the Massachusetts Institute of Technology. The 10,000-member Illuminating Engineering Society is the recognized professional authority for lighting standards in the United States and Canada." . . . After expressing regret about the medical problems of your secretary, **Jack Camp** writes from Mexico, "As for the class notes, I'm sorry but my efforts do not seem worthy of the *Review*, or vice versa." He sends an illustration of the vice versa concept which, however, will have to wait for reunion to be circulated.

In a letter to Jim Evans, **Dan Comiskey** writes from Needham, Mass., as follows: "Grace and I had a wonderful two months in Scotland and Ireland this

summer. They live the relaxed life, as they say, 'God made plenty of time.' The air is so soft and refreshing, the people pleasant and friendly and plenty of good food at reasonable prices. I enclose a clipping about the death of my good friend and helper Walter Humphreys—both he and Dean Burton were very kind and helpful to me. I had a long letter from **Tom McSweeney** who has recovered from a long illness and showing renewed interest in his consulting office in Hingham, Mass. Tell me about yourself! I suppose helping Young America 7 days a week. There are about eight resigning presidents in greater Boston including M.I.T. and Harvard—where are the young folks going in the next few years? We are quite well and still moving around pretty generally." And to our plea for news Dan writes us: "Faithful Bob O'Brien sent me a report of the 1970 reunion with the photo of the group—looked very well to us. Yes, Dan Jr., is teaching math and coaching wrestling at Taft School in Connecticut. We expect to join his family for Thanksgiving and a few days extra (perhaps we'll see Van Lucas who lives nearby). In Massachusetts most people are alarmed at real estate taxes, bomb scares and actual fires (2 in Kingston, Mass., near Charlie Lawrance's home) and with drug problems; the near future is very uncertain, far from calm. What reaction is there from Joe Barker's letter? I can't realize that June 1971 and our 55th reunion is so near."

From his letter **Ev Johnson** retains his good spirits in spite of his disability of a few years ago. We read: "Can do a surprising amount of physical work provided I take it slow and easy. When my heart cut up in 1967 it ended my singing and Sunday School teaching career. But I am called upon quite a bit for consultation. Can you imagine, I had a 50-year career of teaching and a 57-year (career) of singing in church choirs! I thoroughly enjoyed every minute of it. My grandson is a freshman at Louisiana



Technical University at Ruston some 33 miles west of Monroe; until this year it was Louisiana Polytechnical Institute. Last summer he toured England, France and Italy, including living and attending some lectures at Oxford University." Ev also replied to the Alumni circulars: "I located my *Technique 1917* a little while ago; my wife had hidden it in such a safe place that it wasn't found until four years after she passed away. Have been getting a tremendous kick out of it; it is like reliving the times I had at M.I.T." . . . From the far west comes a note from **Steward Keith**: "After demands for hospital payments, doctors bills, local demands, church pledges, etc., I find I have a bit for other projects. Frankly I am far from pleased with colleges (even M.I.T.) and their professors. I am much in favor of Jo Barker's letter to Dr. Bush." . . . From the ancestral home of your Assistant Secretary, Templeton, Mass., **Fred Kenney** writes interestingly of family contacts and adds some items of general interest as follows: "As for the town, not much change in the years I have been here but at present there is a rash of road building. New Route 2 from Gardner to Philipston line (is) due to open by the end of this month. Been retired for 13 years now and manage to be busy although I admit it doesn't take much to keep me so. The lawn, fallen leaves and next the snow make a year-round project. Traveling is out except for a day's trip in the car now and then. Visited Sandwich with its glass works and other museums of historical interest. (My wife and I) spend a couple of weeks leisurely with my family (daughter and son) when their vacation allows, in late July and August on the southeast side of Lake Winnepesaukee. Do a little boating, no fishing."

From Hotel Webster Hall in Pittsburgh, Pa., where **Spotts McDowell** lives, he writes: "There is so much of a sameness to the days, as they pass, that it's very hard to pick out events or incidents that are worth passing on. People come and go each day—only the permanent guests remain. This is a popular hotel for small conventions, for foreign visitors touring the country by bus, and for weddings of local people."

At the time of her death in 1952, my mother left me some old letters from her grandfather to her father, all filled with news about the family, and also other papers. There was so much material about my grandfather that I decided to put it together in the form of a biography. This I have been doing, and have had considerable correspondence with relatives and others to bring out additional information. This project has kept me fairly busy. One of my former co-workers at Harbison-Walker, a retired official, has decided to write the memoirs of his professional career and has suggested that I give him some help, where help is needed. I have been reading the book by Vannevar Bush called *Pieces of the Action*. What a man! The story of his professional career is most inspiring. I consider him a real genius, especially in the field of administration. I am now reading *South America* more or less by Robert St. John. It is quite different from other travel books I have read, and gives a clear picture of various aspects of life in South American countries—told with a real touch of humor."

Your secretaries appreciate your response to our pleas for news. If you haven't already, please write us.—**Harold F. Dodge**, Secretary, 96 Briarcliff Rd., Mountain Lakes, N.J. 07046; **Leonard Stone**, Assistant Secretary, 34-16 85th St., Jackson Heights, N.Y.

## 17

Word of **Ken Bell**'s death on December 16 did not permit more than the announcement in the February notes. In many respects Ken was an unusual man. Warm, enthusiastic, energetic, loyal, he busied himself in many ways: professionally, in music, in his church and family. As a leather treatment consultant for the U.S. Agency for International Development he visited Lebanon, Pakistan, Guatemala, Peru, Kenya and the Dominican Republic. He was honored by Lebanon with the award of "The Order of Cedars" its highest civilian honor. In 1966 Lowell Technical Institute awarded him an honorary doctorate degree. He is survived by his wife Vera, a son and three daughters, nine grand-

children and one great grandchild.

Two other deaths are noted with regret. **John H. Babbitt** died on December 23 in Indianapolis after a short illness. He retired in 1961 after 40 years with the Baltimore and Ohio Railroad. He had served for years as a member of the Educational Council for M.I.T. **Edward Y. Keesler** died on November 27 at Charlotte, S.C. He was president of the Mutual Savings and Loan Association of Charlotte and an ardent tennis enthusiast.

Our Pacific Coast Vice President **Howard Melvin** has again sought news of the 31 seventeneers on the coast by writing his newsy December letter from Los Altos Hills to each one of them. It is such a good letter that it should inspire the recipients to action. He writes: "Pacific Coast living is certainly interesting and ideal so let us tell our classmates what we are doing: trips-golf-fishing-visitors, and particularly if you plan to attend a class reunion during commencement." The Melvins' anticipated trip to the Northwest was postponed when his wife fell and broke her hip. Plans now call for attending a granddaughter's graduation at Washington State University this June when Howard will celebrate his 60th reunion from W.S.U. Afterwards it will be their trip to Alaska. Howard plans on attending the April M.I.T. meeting in San Francisco when the West Coast will host the event honoring Jim Killian and urges other seventeneers to attend.

Unbeknown to World War I Ace, Captain **Arthur Raymond Brooks**, D.S.C., Commander 22nd U.S. Aero Squadron, A.E.F., a copy has been received of excerpts from his diary as published September 1919 by his home town Framingham, Mass. paper. Now with his hesitant permission a portion is quoted. "We were in the Toul Sector with orders to protect a Salmson photographic plane. We were 6 Spads as we crossed the lines at Flirey. Three groups of Fokkers, numbering 5, 6 and 12 were observed and we headed for the 6. The 12 Fokkers then surprised by 'jumping' us. By turning and heading into them they might be separated and a series of 'dog fights' ensue. So I had penetrated their formation."



Captain A. Raymond Brooks, '17

From that time on I never saw another of my mates. At 3 miles up 8 red-nosed Richthofen Circus planes made me an immediate 8 to one shot. I figured that this was the end and I'd get as many as possible before the inevitable.

"For 10 to 20 minutes at 3 miles altitude down to a few hundred feet off the ground, from 10 miles behind their lines and back to ours I passed through rather a mystery. The only thing that saved me was that being at first surrounded, the Germans couldn't shoot at me without being in their own way. Then acrobatics! One red-nosed 'Night Mare' came in on my right. I had just time to dip enough to see his features before I let him have a few incendiary bullets. I turned on another and after a short burst was satisfied that a second had quit although he did not, like the first, apparently catch fire.

"My engine worried me a lot. In certain positions the pressure in my gas tanks failed and the gravity feed was so low I had to conserve it. Once my prop almost stopped dead before I could switch to another tank. I had nosed down when a bullet among others crossed my forehead, 'sliced' through my wind-shield and into my right gun, rendering it useless except for single shots. Finally I was down to 4 Boche and felt better although that gave them better shots at me. A 220 horse power Spad can out-dive a Fokker D7 and for 1500 meters, with full motor, I slipped, dived and slithered, flattening out just over the rolling country. Then I was down to 2 Fokkers and soon one dropped out and then the last one retreated across the lines.

"I was groggy and found it too difficult to fly back to Toul so I bumped down onto a temporary field. I still had my senses but was rather wild and sure that all the others had been wiped out. We did lose two of our comrades. I don't know how I got back. One incendiary had burned itself out in the main spar of my upper wing. Five bullets went clean through the fuselage within four inches of my back. The rudder control wire on one side was useless. All in all there were about 30 bullet holes and the plane was only good for salvage." (Perhaps Ray will now tell us how his plane came

to be displayed in the Smithsonian Institution.)

**Thomas K. Meloy** has a new address at 6631 Iron Place, Springfield, Va., 22151.

The **John Holtons** are wintering at Casey Key on Florida's west coast while the **Ray Stevens** are a bit further down at Naples. . . . **Dud Bell** writes that he appreciates the several notes he has had from classmates. He states that his leg trouble is arteriosclerosis in the ankle and that the treatment is severe and so far questionable but he continues to do his selling work. . . . **Dusty Wilson** comments, "A busy year: (1) trip to Egypt (2) two trips to Brazil (3) trip to India, Nepal and Iran. Some business, some holiday. Also 50th wedding anniversary last May 31st. Both Elizabeth and I are well."

**Harry Wansker** is president of the Sarasota-Manatee Council of the Navy League of the U.S. . . . **Tom Ryan** at Ferguson, Md., is recuperating after an operation for an arthritic hip. . . . **Al Kenigsberg** and his wife had another driving tour of southern Spain and Portugal. . . . Our assistant secretary reports from New York that the **Bob Erbs** are off on a Nairobi safari to return February 18.

The January luncheon at the Chemists' Club was attended by **Will Neuberg**, **Clarence Seely** and **Dick Loengard** along with four sixteeners. Dick called on **Harold Sterner** recently and found him looking well although confined to a wheel chair. He had an exhibit at the Kennedy Galleries in September of some 35 of his paintings. The Loengards are off to St. Croix for ten days in February and will have a weekend in New Orleans in March.—**Stanley C. Dunning**, Secretary, 6 Jason St., Arlington, Mass. 02174; **Richard O. Loengard**, Assistant Secretary, 21 East 87th St., New York, N.Y. 10028

## 18

Recently I dropped in to visit genial Vince Fulmer, Secretary and Vice President of the M.I.T. Corporation, and gleaned the following interesting information. M.I.T. has a Chairman of the

Corporation, a President, two Associate Provosts, an Assistant Provost, nine Vice Presidents, seven Deans and numerous other executives. All of these officers serve the Institute on a twelve-month basis and receive remuneration on about the same scale as that of the senior faculty. The student population (undergraduate and postgraduate) numbers about 8,000 and the budget is around \$200,000,000. Compare this with our day—1914 to 1918—with a President, one Dean, 2000 students and a \$2,000,000 budget—even then our Tech was the elite institute of technology and so recognized world-wide. The important fact I wish to stress is that this 50-year growth has been accompanied by an ever increasing emphasis on the application of technology and science to raising man's standard of living. Now the world is asking us to use our reservoir of knowledge to tackle the problems of poverty and environment—and we are responding to this challenge. I think we can take particular pride in being members of the M.I.T. family—knowing that our "know-how" can serve man well.

Christmas has come and gone. I am happy to acknowledge season's greetings from the Rossmans, the Harrells, the Fullers, the Howes, the Averys, the Kilduffs, Pete Strang, John Clark and Marguerite Willis. Most touching of all these messages was that of **Sax Fletcher**, which I include herewith: "Christmas—Christmas is love, generosity, kindness, joy and laughter. Christmas is beautiful sounds and sights and thoughts. Christmas is caring for others and giving of one's self. Christmas is a miracle and, best of all, Christmas is forever. If God, in His wisdom, ever created one person that best exemplified Christmas, that person was Louise Kitchell Fletcher. She was generous, kind, thoughtful, and had room in her heart to love all people. She possessed all those qualities that make up the Christmas Spirit. Because we are secure in the knowledge that the spirit of Louise Fletcher will live for as long as Christmas itself, we send you best wishes for a Happy Holiday Season. (signed) Sax Fletcher and family."

The season's greetings from Emma and **Harold Atwell** tells of their 1970 experience. They had moved from Wappinger



Falls, N.Y. to Bradenton, Fla., where they now live with their Shasta at the Paradise Bay Trailer Park. They find the climate delightful and at 36 H Street, they now have the most comfortable and convenient home of all in which they have lived. In April they flew to the Orient, visiting Japan, Taiwan, Bangkok, Singapore, and Hong Kong—including Expo '70 in Osaka. The big event, of course, was their golden wedding anniversary, which took place in Wappinger Falls on Sunday, September 27, with over 200 guests, some from many miles distant, whom they had not seen for years. I was especially intrigued with the photograph showing the Atwells cutting the cake. Harold promises to follow up this report with a more detailed biography which will appear soon in these pages.

**Wingate Rollins**, who showed us his motion pictures in November of his six-week trip around the world, reports that his marriage to Sallie took place on November 23, 1968. . . . Keep the news flowing in.—**Max Seltzer**, Secretary, 60 Longwood Ave., Brookline, Mass. 02146

## 19

A note at Christmas came from **Allegra and Karl Rodgers**, R.D. 3, Box 430, Boonton Ave., Boonton, N.J. 07005. "After 13 months we're back in our Airstream travel trailer home in San Antonio, Texas. We spent a pleasant time in Provincetown, Mass., entertaining our children and grandchildren, with very little golf but lots of dancing and some bridge.

**Marshall Balfour** writes he has returned from his Far Eastern trip to Tokyo, Hong Kong, Taiwan and Korea. He returned with a bad case of hepatitis which meant four weeks for recovery. His two daughters and six grandchildren are all moving along; one is at William Penn in Iowa and another at Western Reserve in Cleveland. In August the three families had a pleasant week on the Outer Banks of North Carolina.

**Franklin S. Adams** of 2606 Clark Ave., Paducah, Ky. 42001, wrote that he, **Royden Burbank** and **Edmund Flynn** sat together at Homecoming Luncheon on June 15, 1970.

We were sorry to hear of the death of **Frederick W. Barney**, 3009 Kanuga Rd., Hendersonville, N.C. 28739, on November 24, 1970. Your secretary remembers contacts in the early years of the 20's at the Technology Club at 170 Gramercy Park when Fred was in the paper business.

**Waldo B. Clark** celebrated his 50th wedding anniversary on September 12, 1970. He has two sons (one M.I.T.), two daughters and 10 grandchildren. He retired as a banker in 1967. . . . **Richard S. Holmgren** has enjoyed living in his Airstream trailer during the past year. He has roamed as far north as Port Angeles on Puget Sound and south to Mexico City

and Acapulco, and east to Brownsville, Texas. In June he rode a rubber raft for 350 miles through the Grand Canyon dropping 3500 feet. Some thrill! He is now settling in a mobile home in San Marcos, Calif. Address is 1286 Discovery Rd., Space 103, San Marcos, Calif. 92069. . . . **Robert Burns MacMullin** has had business consultations in both Colombia, S.A. and Greece, as well as regular clients in North America.

**Francis A. Weiskittel** has now become a father-in-law. His 22-year-old daughter married a University of Virginia law student in June 1970, and are now living in Charlottesville, Va. Francis is taking a trip to Japan and Singapore in January and February 1971 with his son.—**E. R. Smoley**, Secretary, 50 East Road, Delray Beach, Fla. 33444 (Phone 305-278-4537)

## 20

Those relatively few hardy classmates who remain in the frozen north are thinking enviously of the many who are basking in the Florida sunshine such as **Dick Gee** and **Harold Hedberg** who are wintering in Ft. Lauderdale; **Dick** and **Billie** at 11200 S.W. 45th St., and **Harold** and **Elsie** at 3333 N.E. 34th St. **Heinie Haskell** compromises at the plush resort of Hilton Head Island, S.C., venturing north only after May 1 to his home in Moosup, Conn. As chairman of Bruswick Worsted Mills—Main Office, Pickens, S.C., and factory at Moosup, Heinie still keeps a sharp eye on operations but finds time for "10 months of good sailing a year." He is expecting to launch his new sloop this month. Heinie qualifies for the class sweepstakes in grandchildren, having no less than fourteen.

A welcome letter from **Art Merriman** says "We enjoyed every minute of reunion thanks to those in charge of arrangements." True to the spirit of M.I.T., Art reports that three of his grandchildren were given scientific presents for Christmas: (1) a miniature motor driven by photo-electric silicon cell, (2) a radiometer and (3), for an 8-year-old girl, an electric light that is in the shape of a butterfly and glows in the dark in various colors. Art sends his best wishes to everyone in the class "for a fine year in '71."

It is with a heavy heart that I must report the deaths of three of our distinguished and valued classmates. Our popular and highly esteemed classmate **Pete Ash** died last November in Mahwah, N.J., after a long illness. Pete had a long and successful career as a civil engineer. He was one of the earliest Marine Corps pilots in World War I and was a member of the Marine Aviation Force Veterans Association. He was an honorary member and former vice president of the Valley Hospital Board of Trustees and a former member of the Black Meadow Club of Warwick, N.Y., and the Triton Club of Quebec. He resided at 10 Glen-gora Court in Mahwah and is survived by his wife, Clarice, and by two sons and

eight grandchildren.

**Charles C. Moore** of Del Mar, Calif., died at almost the same time last November. He, too, was an aviator in World War I, an officer in the U.S. Army, buried with military honors at Ft. Rosecrans National Cemetery in Point Loma. Charles had a distinguished career in chemistry, largely with the petroleum industry. Before his retirement he had been supervisor of fuels and lubricants, R&D, Union Oil Co. He authored technical papers before the S.A.E., A.S.M.E., Bureau of Mines, C.N.G.A. and A.P.C.A. During World War II he was a member of the Naval Aviation Advisory Board. He is survived by his wife, Anne, two daughters and a son.

**Joseph C. Morrell**, '21, writes: "For several years I have been watching your class notes for news of **John R. Bartholomew** with whom I roomed in 1919-1920. I last saw John at the home of Herbert D. Allee, '22, in Grosse Pointe, Mich., during the week of the massive northeast power failure several November ago. I am now informed by the owner of his home at 2700 Berkshire Rd., Cleveland Heights, Ohio, that John died in August, 1969." Our thanks to Mr Morrell for this information.

Word has just been received that **Gerry Tattersfield**, formerly partner of the consulting engineering firm of Tattersfield-Matusow Co. of Philadelphia, is now residing at Hill House 908, Philadelphia. —**Harold Bugbee**, Secretary, 21 Everell Rd. Winchester, Mass. 08190

## 21

The countdown to the biggest event in our Class history has reached the three-month marker and will continue its deliberate pace through April and May to the actual dates of our important 50th Reunion events on June 3 through 7. The list of probable attendees at the '21 Golden Anniversary Jubilee on those five days is just under 300 classmates and wives at this writing. Reunion Chairman **George A. Chutter** is still receiving reservations and we urge you to get yours in promptly. You can get in under the wire by writing him at the address listed at the end of these notes or by telephoning his home, 617 385-3126.

By this time you should have special letters with tentative reunion and Homecoming '71 programs as well as the ordering procedure for your cardinal blazer which has been officially adopted to distinguish classes reaching the 50-year mark. If you register now you will continue to receive further communications, which are being sent only to those who indicate probable attendance. For your own sake and for the many of your classmates who will be present, please don't miss this one big opportunity to enjoy the outstanding anniversary celebration of the Class. Join '21 in 'Seventy-one!

### Mr. American Railroad

According to an article in the *Boston Globe* sent to us by **Ed Dubé**, "The suspicion that only angels can save railroads in New England was given a boost with the naming of **John W. Barriger, 3d**, as president of the Boston and Maine Railroad. Barriger is a cherubic figure in an industry that does not specialize in optimism or smiling faces. But the cherub is going to need more than charm to untangle the snarl headquartered at 150 Causeway St., Boston, Mass. 02114. Fortunately, he has more than that to bring to bear on the problem." The article notes that John has had more than 50 years of experience in the railroad industry; that he is familiar with adversity and made tremendous progress with the troubled Katy in his few years as president and chairman of its executive committee; that he is "a captivating figure" and a "consummate salesman."

We acknowledge with deep appreciation the several letters and personal notes we have received in John's own typing. One, dated last Christmas Eve, includes holiday greetings and the terse comment: "I retire at the end of the year—fired for old age, I call it—for being 71 on December 3." Then, on December 31, a week later, John wrote us: "The principal news, when I retire from the Missouri-Kansas-Texas Railroad at midnight tonight, is that trustees of the Boston and Maine Railroad have invited me to become their chief executive officer as of January 1, 1971. We will move our home to the Boston area in the spring. For the time being our home address will remain 15 Washington Terrace, St. Louis, Mo. 63112." John's distinguished career as a top officer of principal American railroads needs no further recounting here to establish him as the foremost figure in railroad management and in all of that industry's many detailed facets. He and his charming wife, Elizabeth, have indicated from the start of our 50th reunion planning that they would both attend. It is with particular pleasure that we can chronicle their real "homecoming" for this gala event, where everyone will have an opportunity to echo our hearty congratulations and good wishes for this first year of his new association and for many years to come.

### Camp Technology reminiscences

The approaching gathering of the Class of '21 for its major anniversary celebration has stirred up many fond memories of our undergraduate years. Last summer, for example, Anne and **Wallace T. Adams**, 2606 Fleming Rd., Middletown, Ohio 45042, toured East Machias, Maine, and the shore of Gardner's Lake to get a glimpse of scenes that were familiar to Wally around Camp Technology, the Institute's onetime summer civil engineering camp located there. We were just completing for last month's Class News a related note on Marty and the late **William C. Ready**, 1904 Flora Rd., Clearwater, Fla. 33515, when Marty phoned us to tell of Bill's sudden passing. The Readys had contributed a series

of yellowed and crumbling photos of scenes at the summer engineering camp and candid snapshots of students at work and play. The pictures will be on display at the 50th Reunion headquarters with various photographs that you and others have sent us for the occasion.

A long letter from Marty and Bill, enclosing the ancient photographs, told of frequently seeing Muriel and **Victor S. Phaneuf**, University of Florida emeritus professor, who live at 8351 Candlewood Rd., Largo, Fla. 33540, in **Ollie Bardes'** Bardmoor Country Club Estates. The letter also related contact with our long-ago Course VI mate, **T. Dillwyn Dutton**, now of 3379 Sheffield Circle, Sarasota, Fla. 33580. To honor the late **Bill Ready**, a friend in the Class has noted a personal gift to the Amity Fund in Bill's memory, which we commend as a thoughtful means for combining deep sentiment with high practicality in meeting urgent needs at M.I.T.

We have often thought of calling attention to the special monetary gifts which have been made to the Institute over the years by relatives and classmates to honor members of the Class and provide for educational undertakings. We do not have a complete list nor details of those which have come to light. The following are worthy samples: The **John A. Grimmons** scholarship fund memorializes our late classmate. Recently John J. A. Nolan, Secretary-Treasurer of the Class of '03, wrote to Assistant Secretary **Ted Steffian**, advising that an additional scholarship loan fund has been established to honor Jack Grimmons. We have previously publicized scholarship grants established by **Irving D. Jakobson** and **Samuel E. Lunden**. There is also a gift in the name of the Henderson Foundation honoring the late **Ernest Henderson**. Other gifts have been named for the late **George W. Pollock** and the late **Harry Rosenfield**. We welcome anything you can add to this listing.

### Reunion Chairman reports

"Homecoming '71 plans have not reached me in printed form," says Reunion Chairman **George A. Chutter**. He adds, "I am told that the prices and most of the events of last year will be repeated, including the popular 'Tech Night' at the Pops with Arthur Fiedler. The Monday program is most appropriately centered around retiring Chairman of the Corporation, **Jim Killian**, '26. Several of the Class have written me that they already have received beautiful cardinal jackets from our supplier. I saw **Ed Dubé** and **Paul Rutherford** at the Faculty Club gathering of on-campus reunion committees. Ed is doing well." George has furnished a draft of a more detailed program of the events scheduled for the five enjoyable days of the momentous occasion for the Class of '21. By now you probably have this schedule.

The date for your receipt of similar information on the complete Homecoming '71 program has not been supplied to us

at this writing and you may wish to contact the Alumni Office if you do not receive it shortly. Reservations for Homecoming events should be handled directly with the Alumni Association as indicated on the reservation forms you will receive. In connection with the showing at our reunion of slides and motion pictures which have been taken of members of the Class over the years—principally by photo-historian **Bob Miller**—you may also wish to bring along your best slides, motion picture film or photographs for display in June. In the event you plan to bring slides or film, make certain in advance that suitable projection equipment will be provided—or bring your own.

### Class directory changes

These are new listings for classmates and are to be entered in your '21 Directory to keep it current. . . . **Robert W. Barker** now uses his home address, 713 Clarendon Rd., Narberth, Pa. 19072. We presume this means he has retired as principal in the Philadelphia printing press and special machinery firm of **Hess and Barker**. . . . **Frederic J. Grant** has moved from Palm Springs to 612 Palomar Blvd., Ojai, Calif. 93023. . . . **Morris B. Hart** gives Apt. 11, 239 Lexington Blvd., Clark, N.J. 07066, as his present residence. . . . **Henry A. Hutchins** says he has moved locally to 155 South Orange Grove, No. K, Pasadena, Calif. 91105.

Mildred and **Herbert A. Kaufmann** have retired from their American antiques business—Herb's second retirement—and have left Armonk, N.Y., for a sunnier clime. Address them at 3B Sandy Cove Rd., Sarasota, Fla. 33581. . . . **Henry R. Kurth** has a new retirement home at 63 Pleasant St., Box 894, Wolfeboro, N.H. 03894. . . . **Charles F. McGill** now receives his mail at 115 Midway Island Drive, New Castle, Pa. 16105. . . . **Sumner Schein** reports a modification in his address which should be revised to read 64 Arlington Rd, Chestnut Hill, Mass. 02167. . . . **Ralph M. Shaw, Jr.**, is still in the same home—now officially listed by the postal agency as 137 E. Warren St., Beverly, N.J. 08010. . . . **Edward P. Wylde** has gone south from Williamstown, Mass., and says he lives at 1265 Tuna Court, Naples, Fla. 33940.

### An appreciation

The year-end joys are always greatly enhanced for Maxine and your Secretary by the warm greetings received from so many of our loyal classmates and other close M.I.T. friends. Your news and messages of cheer renew our strong bonds and add to the zest with which we tackle the tasks still to be done for the Class and for the Institute. Our sincere thanks go to Anne and Wally Adams, Pat and Allen Addicks, Elizabeth and John Barriger, Ednah Blanchard, Ray Brooks, '17, Mary and Buck Buckner, Ethel Burkett, Jack Cannon, '24, Marion and George Chutter, Beverly and Ian Clark, '61, Mary Louise and Rich Clark, Edna and Phil Coffin, Clara and Asher Cohen, Luisa and Nish Cornish, '24, Kay





T. W. Bartram, '21



Sumner Schein, '21

and Ed Delany, Maida and Ed Dubé, Helen and Ed Farrand, Catharine and Harry Field, Helen and Al Fowler, Eddie and George Gokey, Betty and Morris Goodhart, '35, Harry Goodman, Laura and Bob Haskel, Betty and Sumner Hayward, Betty and Dug Jackson, Ruth and Irv Jakobson, Brenda Kelley, Janet Kreiling, Laurie and Chick Kurth, Alma and Killian Lansingh, '26.

Also to Eileen and Moose LeFevre, Betty Ann and Fred Lehmann, '51, Emma and Al Lloyd, Anne and John Mattill, Elma and John Mattson, Millicent and Joe Maxfield, '10, Anne McCammon, Helen and Bob Miller, Helen Mosher, Kay and Phil Nelles, Betty and Ed Nicholson, '36, Muriel and George Owens, Conchita Pearson, Vivian and Leo Pelkus, Marty and the late Bill Ready, Graciela and Heller Rodriguez, Helen and Ray St. Laurent, Kathy Sayre, Anne and George Schnitzler, Phyl and Don Severance, '38, Debby Shapley, Madeline and Rufe Shaw, Eric Smith, Edith and Harry Thomas, '25, Helen and Lem Tremaine, '23, Louise Tucker, Ruth and Ralph Wetsten, Fred Wheeler and India and Dave Woodbury. Special thanks go to Ollie Bardes for his customary novel greetings via the full-color Orange Bowl souvenir issue of the *Miami Herald*.

#### In the mail

"June will mark our golden wedding anniversary as well as the 50th Reunion of the Class," writes **Thomas W. Bartram**, 9582 141st St. North, Largo, Fla. 33540. He adds that their oldest grandson will be graduated from the University of Idaho in June to enter the Navy as an ensign. Millie and Tom returned home in December from six weeks in Athens, Rome and Florence. . . . **Dayton T. Brown**, 9 Knolls Lane, Manhasset, N.Y. 11030, says, "After having an artificial valve installed in my heart last year, I was kicked upstairs to the chairmanship of our corporation—Dayton T. Brown, Inc., Bohemia, N.Y.—and my son, Dayton T. Brown, Jr., took over as president. In our testing laboratories division, we do a lot of test work for the Navy's space program. We also have a manufacturing division and make parts for I.B.M., Xerox and others. We employ about 400 engineers, technicians and mechanics. Jane and I are taking a trip in February to Australia and New Zealand. We are looking forward to the 50th in June."

**Arnold R. Davis**, 95 Orchard Lane, Berkeley Heights, N.J. 07922, reports:

"I recovered rather slowly from 1969 surgery. Spent last August in Maine and toured Watkins Glen and Niagara Falls in September." . . . **John G. Lee**, Old Mountain Rd., Farmington, Conn. 06032, the retired director of research of United Aircraft Corp., East Hartford, Conn., tells us: "I am a member of the Connecticut Research Commission, a consultant on research administration and very active on the board of the University of Hartford. Living with same wife in same house for 36 years. We have four children and nine grandchildren. My hobby is painting." . . . **Thomas W. Proctor**, Box 37, R.F.D. 1, Darlington, Md. 21034, advises he has retired to his farm in Hartford County, Md., from his consulting engineering duties with the Baltimore engineering firm of Van Rensselaer P. Saxe.

Congratulations and much happiness to **George T. Welch**, 168A College Avenue, Poughkeepsie, N.Y. 12603, who says, "To supplement the note you wrote for the July 1970, issue of the *Review*, Irene Schinzel and I were married on May 2, 1970. We traveled by boat—the *Sagafjord*—to Norway, Sweden, England and Denmark. My daughter, Mildred Clough, has six girls; son Stephan has four boys and Edgar has one son. There are 13 wonderful grandchildren." We had expressed sympathy on the passing of George's wife, Eleanor, with whom he had traveled extensively in Europe since his retirement as treasurer emeritus of Vassar College.

#### In Memoriam

On behalf of his many friends in the Class of '21, we extend their sympathy to the Class of '22 on the death of Eric F. Hodgins last January.

We hasten to correct a report in the January issue of the *Review* and to convey an expression of condolence to **Herbert W. Reinhard**, 257 Cabot St., Newtonville, Mass. 02160, on the loss of his wife last year. The information we had received was in error and we apologize to Herb for any embarrassment it may have caused. We have talked with Herb on the telephone and he assures us he will attend the celebration of our 50th anniversary in June.

The Alumni Association has recorded the passing of three of our members and we extend sincere sympathy to their dear ones.

**Edward Grant Sparrow**, 1 East 66th St., New York, N.Y. 10026, died on November 15, 1967. A member of Delta Psi at the Institute, he was associated with us in Course VI in the freshman year. In World War I, he had been a private, Marine Corps, and had served in the American Expeditionary Force. He earned the A.B. degree and spent most of his business career in Paris, France. He was a special attaché of the Banque de Paris et des Pays Bas and then managing director of the Société Franco Américaine d'Etudes et de Participations Financières, also in Paris. He spent

several years in New York before retiring to a home in Paris. He is survived by his wife, Mrs. Catherine Sparrow, who now makes her home at the New York address.

**Robert Arthur Eckles**, of Apt. 33W, Beacon House Tower 2, Naples, Fla. 33940, died on January 31, 1968. He was born in New Castle, Pa., on March 8, 1898, and attended Amherst where he was a member of Delta Upsilon. In World War I he was a private in the S.A.T.C. at M.I.T. Joining us in the sophomore year, he was a member of the executive committee of the Architectural Society, Frieze and Cornice and the Civil Engineering Society. Bob was graduated in Course IV and spent his entire professional life with the New Castle architectural firm of W. G. Eckles Co., becoming a partner before he retired in 1963 and moved to Florida. He is survived by his wife, Mrs. Margaret A. Eckles.

**Alfred Bixby Quinton, Jr.**, retired Army major general, of 4000 Cathedral Ave., N.W., Washington, D.C. 20016, died on September 25, 1968. His army service began in 1912 following his graduation from Cornell with the C.E. degree. He was associated with us in the senior year, earning a master's degree in Course II. He had served variously as a major, Ordnance Dept., Aberdeen Proving Grounds; lieutenant colonel and chief of the department's procurement planning division, and later as major general and commanding general of the Ordnance Dept. until his retirement. His decorations included the Distinguished Service Medal, Legion of Merit, Commendation Ribbon, Commander of the Order of the British Empire and Black Star of the French Legion of Honor.

#### Join '21 in 'Seventy-one!

What a treat is in store for you at the 50th anniversary jubilee of the Class in June! Participation in cap and gown in the academic assemblage at commencement; social hours with your best friends on earth; scenic tours; meetings with distinguished members of the faculty and administration; a shore dinner; a Class banquet; '21 pictures of yesteryear; the "Pops;" a '21 memorial service; the general alumni luncheon and reception for Jim and Mrs. Killian; sports, recreation and free hours to use as you wish—all in those distinctive and useful blazers! Make your reservations right now for your wife and yourself so you both can enjoy this principal reunion of the Class of '21. And while you're in the writing mood, please return to your secretaries immediately that 50th Reunion data sheet forming the last page of the Class Directory you have received. We urgently need your news and help.—**Carole A. Clarke**, Secretary, 608 Union Lane, Brielle, N.J. 08730; **Edwin T. Steffian**, Assistant Secretary, Steffian, Steffian and Bradley, Inc., 19 Temple Place, Boston, Mass. 02111; **Sumner Hayward**, Assistant Secretary, 224 Richards Road, Ridgewood, N.J. 07450; **George A. Chutter**, 50th Reunion Chairman, Box 305, Boulder Drive, East Dennis, Mass. 02641

We feel that Buffalo is blest again in January as we read of snow along the eastern seaboard and through the West and South—but it's difficult for the merchants selling sleds. However skiing is "good to excellent" on our slopes a few miles south of the city. In the meantime M.I.T. has advised us of the work done by the Presidential Selection Committee and the M.I.T. Commission governing M.I.T.'s future. Our classmates who attended the fall meeting of the Alumni Advisory Council included Parke D. Appel, Warren T. Ferguson, Oscar H. Horovitz and Theodore T. Miller. The previous meeting was also attended by C. Yardley Chittick and Robert Tonon.

Our Christmas card from **Frank Kurtz** of Del Ray Beach was mailed from Medellín, Colombia, listing their family as Dick, Harry, Sheldon, Leslie and Compton. We are sorry to miss Carlys and Frank this winter in Florida. . . . We were happy to hear from our favorite 1922 Class Agent **Dale Spoor** of Richmond as follows:

"I have had a little job with the Small Business Administration of the Federal Government here in Richmond for just a little over seven years. The job is running out at the end of December, so I will be 'foot loose and fancy free' once again. In order to have something to do, since both Katherine and I are in good health and in good spirits, we are leaving from New York on January 23rd for a 90-day round-the-world cruise on the *Rotterdam*. When we were in Hong Kong nearly eight years ago, this beautiful ship was in the harbor on its round-the-world cruise, and we went aboard to look it over. We made up our minds at that time that if and when we were on the loose again, this is something that we would like to do. We go south to Port Everglades, Florida, then down to Rio, across the south Atlantic to Cape Town, South Africa, and have a few side trips such as a four-day safari to Victoria Falls and Kruger Park to see the wild game, then over to Bombay, with a three day trip to the Taj Mahal, Jaipur and Delhi, thence to Singapore, Bangkok, Hong Kong, Japan, Honolulu, and across to San Francisco. From there we go south to Acapulco, Panama Canal and back to New York on April 21st. So for a period of several months, after about the middle of January, your Class Agent will not be writing any 'Thank You' letters—I hope there will be at least a hundred more to write when I get home the first of May! So far 1922 seems to be supporting the M.I.T. Alumni Fund in its usual handsome style, and I am sure that for the first time this year, we will have 50 per cent participation." We all wish a good sailing to Katherine and Dale. The *Rotterdam* is a beautiful ship. Dorothy and your secretary were aboard last January to see friends at Port Everglades.

Our sympathy is extended to "Luke," **Willett Walton, Jr.**, of North Edgecomb, Maine, whose wife and partner Gertrude suddenly passed away last September.

They had had an exciting spring and summer with their nursery and landscaping business which they thoroughly enjoyed. . . . We also extend our hopes for an early recovery to **Charles S. Comey** of Sun City, Ariz., who was seriously injured in an auto accident during October as he was driving through Louisiana on the way home. Mrs. Comey had gone ahead by plane. We trust that his prediction of "soon being back in action" has come true. . . . **Irwin J. Smith Jr.**, of Loudonville, N.Y., is president of Surpass Chemical Co. of Albany, N.Y. Irwin and Madeleine have a son and daughter and three grand daughters. . . . **Roland L. Smith** of Charleston, S.C., has retired from civilian service in the Public Works Department of the U.S. Naval weapons station. Here is one classmate who doesn't have to "go south." . . . **Edward A. Merrill** of San Francisco has written about the total dependence on highway transportation for personal travel in the urban areas. He says that as new urban routes are opened, congestion is not reduced. He suggests a reorientation of priorities and re-allocation of available funds to provide attractive, effective alternatives in urban centers.

We are sorry to read of the death of **Eric Hodgins**, formerly publisher of *Fortune Magazine* and vice president of Time, Inc. We all enjoyed his *Mr. Blanding Builds His Dream House* and were enlightened by *Episode* which was subtitled "Report on the Accident Inside My Skull." He said about his Dream House: "Everything pleasant happened to that effort; this has caused me many times to reflect on the total disrelation between struggle and reward." Of course, he gave some credit to the movie (1948) starring Cary Grant, Myrna Loy and Melvyn Douglas. We remember that Eric wrote most pleasurably at M.I.T. leading him into journalism from his school of chemical engineering. He wrote for various magazines and then became associated with *Fortune* and *Time*. He is survived by a son, Roderic Carlson, a psychologist at Harvard University, a daughter Patricia, of Boulder, Colo., and two grandchildren.

Our sympathy is extended to the family of **Peter T. Lamont**, of Greenwich, Ct. He was a retired vice president and director of Standard Oil Co (New Jersey), a navy commander in World War II and later became a marketing advisor for Central Europe, the Mediterranean area and West Africa in 1960. . . . We also send our sympathy to the families of **Phillip Caplain** of Miami Beach, **Edward A. Larner** of Amherst, N.H., Mrs. **Elizabeth Hawks**, Southboro, Mass. and **John O. Beasley** of Alexandria, Indiana.

The changes of address received include Oscar H. Horovitz, Pompano Beach, Fla; Prof. Edmund D. Ayre, Santa Barbara, Calif; and Clinton B. F. Brill, Tallahassee, Fla.

We end this epistle with happy hopes for all; good health and snowy ski slopes or sunny beaches as you individually prefer.—**Whitworth Ferguson**, Secretary, 333

Ellicott St., Buffalo, N.Y. 14203; **Oscar Horovitz**, Assistant Secretary, 45 Gerard St., Boston, Mass. 02119

A letter from **Alan R. Allen** states that he has been hit with a severe case of arthritis. He has had symptoms of this for about 16 years. Last May he was walking with two crutches and was destined to a wheel chair for the rest of his days. In June he went out to Arkansas and Oklahoma where he has been completely cured. He can now do a hop, skip and jump, sit on the floor and play marbles, and run upstairs. (That's the old fight, "Al". Keep it up!) "Al" reports that he has finished editing the films of our 45th reunion and that they have turned out marvelously. Our thanks to him.

**Samuel L. Williams** reports that in early November he spent a few days at a camp in the Pennsylvania Mountains with **Uncas A. Whitaker**, and some other friends of the Westinghouse Airbrake Company. "Whit" is a member of the Corporation Committee looking for a successor to President Johnson of M.I.T. Sam Williams was also with **Lyman L. Tremaine** in New York for an afternoon and evening and states that "Lem" is in good shape. . . . **Arthur S. Stuckey** (who stepped in front of a truck in the fall of 1922, and had seven deficiencies at the beginning of 1923 due to lost time, and who demonstrated his tenacity and scholarship by overcoming all the work and being graduated in June, 1923 with his class) says that writing letters is his most difficult activity these days. How "Art" has changed! I wonder if he continues to read as many books as ever.

**Thomas E. Rounds** recently took a 747 plane from Los Angeles to New York. His report of the flight is briefed as follows: "Left Los Angeles an hour late due to extensive search of baggage and passengers for weapons. Found none. Good flight to New York, but stacked up over Colt's Neck, N. J., for 1½ hours. Tried landing at Kennedy Airport, with Tulsa, Oklahoma the only alternative, as the weather was bad all over the East. Landing was impossible as was the next abortive attempt. Then flew toward Dallas but changed to Tulsa because of head winds. Re-fueled at Tulsa. Passengers were hungry because the food was all gone and there was no more coffee. The plane landed in Dallas, and a few hours sleep were obtained before the next day's flight to New York." In spite of malfunctions of unimportant equipment, such as food-ovens, movies, and stereo-sound, "Tom" is convinced that the 747 is a good airplane. It appears that his experience with the performance of the plane under unusually bad conditions justifies this statement.

**Thomas L. Powers** reports that he is still living in Fargo, N.D., at the Powers Hotel which his son manages for him. . . . Lieutenant Colonel **Philip S. Wilder**, USAR-Ret., has been elected vice presi-



dent of the Green Mountain Association of the United States. He is adviser to foreign students at Bowdoin College.

A letter from **Milton E. Parker**, former Professor and Director of the Department of Food Engineering at the Illinois Institute of Technology, reveals that in addition to his other activities he has been inventor or co-inventor of 16 U.S. and 2 Canadian Letters Patents involving food and animal feed products, food processes, chemical processes and control equipment developments of commercial significance. Congratulations to you, Milton, for your contributions in the progress of food technology. . . . No changes of address have been reported for this issue.—**James A. Pennypacker**, Assistant Secretary, Long Hill Road, Essex, Conn. 06426

## 24

Transferring the scroll and pen from ex-Secretary **Chick Kane** to the under-signed was carried out on December 15 with all the fanfare of an execution. At Chick's nature study headquarters in Lincoln, his good wife Betty provided morning coffee and brownies, while in the presence of **Frank Shaw**, Chick stealthily slipped 1924 documents to the writer. This was something like the Union Pacific handing its railroads over to the Penn Central, saying, "Here, you run it!" Mates, I will do my best, but never could hope to obtain the nostalgic twist to the Notes as the unforgettable Chick Kane.

Perhaps it is fitting that our beloved Chick Kane left the woods and fields which he loved so dearly on the birthday of Abraham Lincoln. He harbored hate for no one. Always steady in the stream of controversy, his soft, low voice, quick wit and choice of words invented a balm to soothe the rash of tension. Offering advice only when asked, but honest, courageous and sympathetic, his sincerity and simplicity earned the trust of his associates, classmates and alumni.

Chick was a liberally-educated man, articulate both in speech and writing, but we knew him best for his unforgettable caricatures and burlesques. He knew a great deal about the world of nature. His camera shot photographic masterpieces. He loved his family and children were the inspiration for his superbly illustrated "Tale" publications.

His years of devotion to M.I.T. and his fellow classmates place him in the unchallenged rank as the most widely-loved figure in the Class. Time has crumpled the cement that bound us together, but the memory of Chick (Henry B.) Kane will forever be the guiding star for our loyalty to M.I.T. and the Class of 1924.

Another of our illustrious members, **Charles Allen Thomas**, former president and board chairman of Monsanto Company, has been honored with a "Dis-

tinguished Alumni in Science" citation from Transylvania University, Lexington, Ky. A 1920 graduate of Transylvania, he was also awarded an honorary Sc.D. degree. The Frances Carrick Thomas Library there was named in honor of his mother. Dr. Thomas earned an M.S. degree at M.I.T., and is the author of numerous scientific books and articles. He holds 86 U.S. and foreign patents, principally in the field of organic chemistry.

During World War II, he was one of the principal scientists in the development of the atomic bomb, having had charge of the final purification and metallurgy of plutonium, the 94th element. In recognition of his wartime work on atomic energy, he received the Medal of Merit from the then Secretary of War, Robert F. Patterson. Dr. Thomas was one of the five co-authors of "A Report on the International Control of Atomic Energy," commonly known as the Acheson-Lilienthal Report which was prepared for the Secretary of State's Committee on Atomic Energy. He is also a founding member of the National Academy of Engineering, and holds life membership in the Corporation of the Institute.

News on activities via the Alumni Fund office comes scribbled in the designated return envelope spaces from: **Robert Q. Dehlendorf**: "Just moved back to La Jolla, Calif. after 2½ years in San Francisco area. Felt the need for warm and smogless climate. Also might need the Mexican border as an escape hatch after all the condoned recalcitrant people take over."

**Luis A. Ferre**, Governor of Puerto Rico, a strong advocate of Statehood for the Commonwealth, has not avoided difficulty in his untiring efforts to improve the life of his people on the Island. A militant fringe of "Independentistas" have learned the knack of assembling bombs and have experimented with them in San Juan, where a million tourists are attracted each year. The culprits have not yet learned that they are the big losers, for what good is a devalued economy?

**Edward H. Moll**, in case your memory has degenerated, is our Class President. His new addresses: Burkehaven Road, Sunapee, N.H. 03782 and Box 103, Sturbridge, Mass. 01566 are puzzling although this is nothing new for Eddie. Since graduation, his trail has led from textiles to copper to aluminum to axles to fuel injection pumps. A man of many facets, but never prophesied as retiring from a bull in a China Shop to become a consultant for the famous Sturbridge Village. Perhaps this spawned his idea for our 50th-Year Gift—financial support of an environmental laboratory—the relation of life to environment.

Bong! **George Tapley** gasps: "After five strenuous and productive years with the City of Haverhill, I am retiring December 31. We are planning to winter in Venice or Englewood, Florida, and possibly will acquire a mobile home there for future winters." . . . **John Fitch** and Mary ap-

parently are not weaned from their South American habitat: "We are finally settled in sunny Florida and we love it. It is going to be fun moving with the warmth from here to Massachusetts every spring as long as we are ambulatory. Not a bad life back here in U.S.A." . . . **Bill MacCallum** and Eleanor (Los Angeles) spurred on by the Indian takeover of Alcatraz, explored more of the West, particularly the Indian country of Arizona. Also, on the way back from the Mediterranean they stopped in Massachusetts to see their young squaw and brave. . . . We are not sure that **Mark Sinnicks** was seeing well, but he says that he ran into Johnnie Fitch on the street in San Francisco in November. "Long dry Summer in the Sierra, so we went to Hawaii in early October." He should have waited, as the Bay area had 12 days of steady rain beginning late in November. . . . **Clinton Conway** and Allora remembered us with a photographic card, in color, and a St. Pete hacienda background, stating: "This is the way we looked last January. This year the grass is a bit greener." Seems to mean that Clint has reduced his business activities and given nature a chance. . . . We were happy to hear from **Mrs. Ed Winger** through her annual greeting and thoughtfulness in memory of Ed. (How the world needs more of his humor and gentle ways!) Helen has been travelling to spots on the East and West coasts to become better acquainted with her granddaughters.

The writer, as a participant in the Telethon carried out for the Alumni Fund on the evening of November 10, found it no chore. The calls were fun and interesting but also had their sad points. We learned, belatedly, that **Louis Porter** in New York, had retired in 1966 and passed away on Thanksgiving in 1968. I remember Lou as a very good dash man on the 1923 track team, and particularly in the Harvard Dual meet, when he won both the 100 and 220—a real feat against Harvard. Our sincere condolences to Mrs. Porter, 404 Riverside Dr., New York, N.Y. 10025.

**A. Whitney Rhodes**, known to his associates as "Dusty", passed away in February 1969, in Englewood, N.J. He came to us from Harvard and was active in several Institute organizations and stylus. We extend our sincere sympathy to his family.

We had word that **Alexander J. Bone**, Emeritus Associate Professor of Civil Engineering at M.I.T. had not been feeling up to par. . . . **Maynard L. Harris**, having gone from civil engineering to banking, to retiring, took to horseriding. Recently, his plug stepped in a hole, throwing Lank to the ground and resulting in painful discomfort. His ribs and vertebrae are mending slowly, at least enough to allow a drive to the Prudential building, once a week, from Carlisle, Mass.

We have received a half page, full column display from the November 1970 issue of *Aeronautics & Astronautics* headed "Evolution of the Jet Engine," under which is a photograph of **Edward**

**S. Taylor.** Below this his nutshell biography reads: "An M.I.T. graduate in 1924, Professor Taylor joined Wright Aeronautical Corp. in 1924 and then in 1927 returned to M.I.T., his home base until he retired in 1968, as Director of its Gas Turbine Lab. He served with the WW II War Production Board, the N.A.S.A. Special Committee on Jet Propulsion, and other influential groups, as well as being consultant to Curtiss Wright and General Electric." Below a large open space appears "Eleventh Annual Lester D. Gardner Lecture." As Ed is Professor Emeritus of and Senior Lecturer in the M.I.T. Department of Aeronautics and Astronautics, we are not clear as to the display heading. Was it a lecture subject or an addition to his list of erudite publications? An answer, please, Ed!—**Russell W. Ambach**, Secretary, 135 Aspinwall Ave., Brookline, Mass. 02146

## 25

With the coming of spring and the sports car racing season it may be of interest to know that one of our classmates, **Alec Ulmann**, was the founder of the Seibring sports car classic which celebrated its twentieth anniversary last year. Alec, a native of Russia, was forced to flee with his parents in 1919 and he enrolled at M.I.T. at the age of seventeen where he received his Master's and from all accounts has since had a varied and interesting career. Although his main interest is in the field of aviation, he is president of Allied International Corporation, an overseas organization that deals in airline parts and equipment. He is a collector of cars and a member of the Madison Avenue Sports Car Driving and Chowder Society, an organization that admits, with tongue in cheek I am sure, that it has small hope of upgrading the class of its membership as most new members are friends of present members.

Miscellany: **Charles M. Cooper** writes he is still doing a little consulting. . . . **Cuthbert Daniel** for the past twenty-three years has been an independent on the design of industrial experiments and on fitting equations to multi-factor data. A book on the latter, with F. S. Wood, appeared in February. He received an Outstanding Statistician award from the Chicago chapter of the American Statistical Association last year. . . . **John M. Campbell** attended an M.I.T. Chemical Engineering Convocation last October.

**Joseph E. Russell** observes that he still appears to be in excellent health, playing golf two or three times a week and tennis on weekends. He also "dabbles" at selling by-product alcohol solvents and in making activated carbon from rice-hulls. . . . **James C. Evans**, a recipient of the Secretary of Defense Meritorious Service Award and Medal, has recently retired after thirty years as Counsellor in the Office of Secretary of War/Secretary of Defense in the Pentagon. . . . **Jim R. G. Hardy** has travelled a great deal in the past forty-five years. He has suffered some ill health but writes,

"by GAD I have a fine daughter and son-in-law who gave Hildegard and me two dandy wee grandsons. What more could a man want?"

I had just received a comment from **Carl R. Mabley, Jr.** in which he humorously said that in retirement as a marketing consultant he did not have enough time for paying clients because of non-paying ones when I was shocked to receive a clipping from Jim Clifford announcing Carl's death on November 26, 1970. Carl was retired as president of the Island Creek Coal Sales Co. He served in the Army Quartermaster Corps as a fuel specialist achieving the rank of Lieutenant Colonel and was awarded the Bronze Star and the Legion of Merit. I also regret to report the deaths of **Mrs. Ellen P. Rieg** of Orange, Mass. on May 13, 1967; **David T. Bulkley** of New York City on July 16, 1970; and **Nelson H. Defoe** of St. Croix, U.S. Virgin Islands on December 5, 1970.—**E. Willard (Will) Gardiner**, Secretary, 3 Foster St., Cambridge, Mass. 02138

## 26

Seldom do we start class notes on a Saturday evening but the mood seems right. The curtains have been drawn over the sliding doors, our collie "Heather" is curled up at my feet and a special martini rests on the table at my side. What's so special about it? The olive—it's made like those served in a Detroit restaurant I visited some years ago—the center is stuffed with anchovy and must be stuffed fresh. This restaurant has people coming from all over town to purchase these olives for their cocktail parties. You see the olives are so good you must have another martini to get another olive—which reminds me . . .

The sea has been relatively calm today but as we write we can hear a rhythmic pitch as it breaks on the boulders below. Ruth is in the kitchen preparing the Saturday night beans so there will be "time out" soon. In laying out our material (on the floor) the priority seems to be on our coming reunion. You will have received one or more letters from Don Cunningham and Pink Salmon by now but we can add a few words. Chatham seems like a great place for us on our 45th. Most of our reunions have been on the Cape. We got to Toy Town Tavern for our tenth (and I doubt that they would even take us back) and to Old Lyme for our fifteenth but even our fifth was at Plymouth which is almost the Cape. So there is something nostalgic about going to Chatham for our 45th since Chatham is about as Cape Cod as one could ask. Quite a few of the class have homes on the Cape—Harry Howard, Elton Staples, Sam Brooks, Bob Conly and Flint Taylor but none have an address like Johnny Spence: 11 Hole-in-One Drive, South Yarmouth, Mass.!

We will be getting together so soon that there will be an opportunity for everyone to exchange "news." However, there are

a few items that cannot wait. One is an award received in late November by **Jim Killian** and we quote from the *New Englander*: "Dr. James R. Killian, Jr., Chairman of the Corporation, Massachusetts Institute of Technology, Cambridge, Mass., was presented with the sixth New England Council 'Man of the Year' Award, November 20, at the Council's 45th Annual Conference in Boston. Dr. Killian joined five previous New England 'Man of the Year' winners. The award is presented to the New England individual or organization who by unique achievement has rendered a distinguished service to benefit his fellow citizens. The selection of candidates is with primary emphasis on outstanding service to New England as a whole as well as in their particular endeavor."

"Dr. Killian assumed a leading role in New England's economic recovery after World War II, an economy that polarized on science. Under his leadership—as President of Massachusetts Institute of Technology—the Institute, and other of the region's schools, transformed New England into the world's leading center for research and development."

"Dr. Killian is currently Chairman of the Corporation of M.I.T., a post he has held since 1959. He served as Special Assistant for Science and Technology, 1957-59, for President Eisenhower, and further as Chairman of the President's Science Advisory Committee. He has also acted as advisor to four presidents and has been the recipient of 38 honorary degrees. Besides participating in government advisory and study groups, he has been a member of commissions and groups studying national problems. He served as a member of the Committee for the White House Conference on Education, 1954-56; President's Commission on National Goals, 1960-61; and in 1968 he was elected as a Director of the Corporation for Public Broadcasting."

In October Jim received a similar honor from the Amalgamated Clothing Workers of America and Ruth and I had the privilege of attending this testimonial dinner. It's great to be able to bask in the reflected glory of our distinguished classmate.

Now who do you suppose we have heard from after all of these years—none other than **Barron P. Lambert!** Here's what "Bean" has to say. "Dear George: Not having previously made a note of your address, I have awaited arrival of a *Technology Review* in order to inform you of the sad news that our classmate and my dear friend **Ted (George) Faithfull** died last October 25. I attended the service as did John Hoxie and Dick Whiting, who were his law partners."

"On the more cheerful side, in Paris last spring, Mary and I were most cordially entertained by **Fred Walch** and his very charming wife. I also keep in touch with **Ned Lame**—Dr. Lame, that is—who seems partially retired but still head of the Radiology Department at



(I believe) the Presbyterian Hospital in Philadelphia. I retired prematurely myself four years ago to devote myself, not to advising anybody about anything, but to do minimum wage outdoor work, a spot of tennis, learning to paint, enjoying my beautiful and comparatively new wife and to help my friends drink their cocktails. I was glad to read that **Bill Millar** is having a good retirement along with having kids in school! Terrific. Sincerely, 'Bean' Lambert."

The one thing Bean did not say was that he is coming to our 45th so we will just assume that he will be there just like we are assuming you will be there too. So saying we find that our class notes space is filled and it's still Saturday evening although by now, as I hear from the T.V. in the distance, it is Laurence Welk time and time to take Heather for her evening walk so—Cheerio until April.—**George Warren Smith**, Secretary, P.O. Box 506, Pigeon Cove, Mass. 01966

## 27

"Confusion worse confounded"—Milton. The account of the awarding of the U.S. Atomic Energy Commission Citation to **Dr. George Darling** was split between the November and December classnotes, and now I have a good picture of George and his wife taken at the time of the proceedings. Though late, I am anxious to run it. I am sure that George's friends of undergraduate days will find him very recognizable.

We were glad to receive this letter from **Frank Staples**: "I was very sorry to read in the Notes about the death of General Glantzberg, and I also learned of his passing when I recently visited in Savannah, Ga., where Fritz lived a number of years and was highly respected . . . After forty-one years with SuCrest Corporation (formerly American Molasses Company) and fifteen years as its president, I have stepped down and turned over most of my burdens to someone else. I am still employed as an advisor and consultant and have a nice office and come in three or four days a week, but get in late and leave early. I am still a director and chairman of the executive committee and I am working on several jobs, but they are jobs that don't have to be done tomorrow. Thus, it seems to me that I have the best of both worlds and like to compare my present job to that of being a grandfather . . . all the fun but none of the responsibility." Good luck in your quasi-retirement, Frank.

**John Drisko** says that his dam in Pakistan will be completed in 1976, but he doesn't say whether he expects to hang around to finish it. . . . **Gordon Calderwood** retired from Rochester Gas & Electric Corp. a year ago. He and his wife, Lucie, still live in Rochester, N.Y., but spend much of the summer at their log-house retreat overlooking Canandaigua Lake. He is enjoying color photography, oil painting, hiking, and his



Mr. and Mrs. George Darling, '27

grandchildren. His community interests are Rochester Safety Council (board of directors), and first aid advisory committee of Rochester chapter of the Red Cross. Gordie sends on the word: "Delighted to see any classmate travelling in this area." . . . **Al Buffum** has now fully retired. He was able to carry out his plans last year to fish in Canada and Iceland. Now he has plans to pursue this hobby in the South Pacific and the Orient. . . . **Fred Willcutt** wrote on his Christmas card: "I was sadly surprised to learn of Fritz Glantzberg's death last July. He always impressed me as being so strong and rugged; it never occurred to me that he would be leaving us so soon. In track he used to win first place in hammer throw and shot put and I'd try to follow along with the seconds and thirds

"Well, I'm in my first retirement phase—three months' leave preceding February 1 retirement. The position I left was manager, Systems Planning Department, Potomac Electric Power Co., to me an exciting assignment." . . . **Charlie Smith**, on his Christmas card, says: "We are looking forward to seeing everybody at the Reunion in 1972. Also, we may stop in and say hello to you in Mystic next June on the way to Eleanor's reunion in New London. We went to Oberammergau for the Passion Play last September and business in London after a visit to Paris. We leave the first of the year for three months in Arizona and a good rest down near the Mexican border in the sunshine."

We have a communication from **Frank Kear** (our first): "Still putting television stations on tall buildings and towers—then moving them to taller buildings and/or towers. However, much prefer entertaining my six grandchildren—or maybe they entertain me." . . . Twenty-five years ago, the war was well over. **Joe Melhado** had retreated from the War Production Board in Washington and bought the house in Scarsdale, N.Y. where he now lives; **Emory Patterson** called a halt to the manufacture of Quonset huts at Great Lakes Steel in Detroit, where he worked. . . . With retirements, news for the Notes is getting scarcer. How about somebody writing me that he or she has become a great-grandparent?—**Joseph S. Harris**, Secre-



F. C. Staples, '27

tary, Box 654 Masons Island, Mystic, Conn. 06355

## 28

Once again the holiday season has occasioned many welcome greetings and notes from classmates. Your Boston area group was very pleased to receive cards or notes from the following: **Clare and Arch Archibald**, **Marjorie and Bill Bendz**, **Ruth and George Bernat**, **Dorothy and Fitch Briggs**, **Ruth and Chris Case**, **Jan and Jack Chamberlain**, **Marie and George Chatfield**, **Alice and Vic Decorte**, **Ana Teresa and Mariano Contreras**, **Helen and Gabe Disarlo**, **Fran and Jim Donovan**, **Helen and Roland Earle**, **Olive and Newton Foster**, **Trudy Francis**, **Martha and Don Fraser**, **Dorothy and Carney Goldberg**, **Sally and Bill Hall**, **Helen and Bob Harris**, **Irene and Ted Hartshorne**, **Priscilla and Roger Haven**, **Anne and Walter Hildick**, **Shikao and Asako Ikehara**, **Florence Jope**, **Adrienne and Art Josephs**, **Louise and Ernie Knight**, **Kathleen and Bob Larson**, **Lillian and Tom Larson**, **Janet and Fred Lewis**, **Bonnie and Vernon Lewis**, **Alice and Slim Maeser**, **Kitty and Paul Martini**, **Dora and Dave Mathoff**, **Bill McClintic**, **Bea and Johnnie Melcher**, **Francis and Karl Meyers**, **Helen and Bob Murphy**, **Mary Nichols**, **Lela and Walter Nock**, **Maxine and Karl Otte**, **Anne and George Palo**, **Mary and Max Parshall**, **Gladys and Bill Phillips**, **Ed Pitt**, **Edythe and Dick Rubin**, **Pam and René Simard**, **Verna and Rudy Slayter**, **Betty and Dud Smith**, **Walter Smith**, **Helen and John Stack**, **Ed Stevens**, **Hirsh Sulkowitch**, **Dorothy and Herb Swartz**, **Sam Weibel**, **Edith and Ray Wofford**, **Ann and Bill Woods**, **Ruth and Abe Woolf**, **Velma and Charlie Worthen**.

In many cases news items were included and we are pleased to pass them along to you: **Ruth and George Bernat** report that they have become grandparents for the first time. George says that granddaughter Karen is very, very beautiful.

**Dorothy and Fitch Briggs**, spent a month last summer in the Pacific Northwest and Alaska; next summer they expect to be in New England. . . . **Ruth and Chris Case** have suffered a misfortune.

After only ten days of vacationing in Maine last summer Ruth fell and broke both her left wrist and left hip. She is only now getting back on her feet. Ruth has retired from teaching and Chris expects to retire in the near future. . . . **Ana Teresa and Mariano Contreras**, Helen and **Gabe Disario**, with Alice and **Vic Decorte** had a small reunion in Caracas, Venezuela early in December. They suggest holding the 45th in Caracas! . . . **Roger Haven** says that he retired on December 1 and that he and Priscilla are still trying to get reorganized. . . . **Shikao Ikehara** still has pleasant memories of the 40th in Cambridge. . . . Helen and **Bob Harris** are enjoying their new life in St. Paul, Minn. but miss some of the things back in Cambridge. . . . **Ernie Knight** reports that his family is well and that son Paul is now at Communications School (Army) at Fort Monmouth, N.J. . . . Kathleen and **Bob Larson** congratulate themselves on being 28ers. They regard our reunions as a very bright spot in life and hope they will be continued as long as there are classmates able to attend. . . . **Dave Mathoff** says he must stay indoors until March or April when the weather will be mild again. He is looking forward to when he can be out and about. . . . Mary Nichols is occupied full time at the Waltham (Massachusetts) Hospital as reception coordinator. She is very busy and finds the work most rewarding.

**Walter Nock**, now retired, has moved into a lower-level apartment to ease an arthritis problem. He and Lela are determined to get his health improved so they can do some traveling and enjoy life more fully. Their son Ron was married recently and, with his bride, will live in Mexico City where he is on assignment with his company. . . . Anne and **George Palo** had the best summer ever last year when they rented a house in London, England for three months. They enjoyed the theater, operas, museums, exhibitions, sailing, and tennis at Wimbledon. They had many friends with whom to share their fun. George still takes on an occasional consulting job. . . . Mary and **Max Parshall** enjoy their new home in Hamilton, Montana more and more. They had a good summer last year, raised a nice garden and had lots of visitors. . . . Pam and **René Simard** enjoyed a perfect three-week vacation in Tahiti but this was followed by a bad two weeks in the hospital for René. He lost much of his blood supply through intestinal hemorrhaging. This was attributed to the continued use of dicoumaral anticoagulant that was initiated six years ago following a coronary. René is all right now but hopes that his experience will serve as a warning to others who may be on similar medication. . . . Betty and **Dud Smith** sent in a lively report of their busy year. We can do better justice to this letter in a later writing. . . . Edith and **Ray Wofford** continue to enjoy their retirement at Lake San Marcos in California. Everyone is very friendly but there is so much going on it keeps them both very busy. Edith is active in civic and women's clubs while Ray is president of the Fishing and Casting Club and a board

member of the golf club. They feel most happy with their lot, especially when they read of winter blizzards in New England.

Ruth and **Abe Woolf** sent a note from Bethlehem where they were attending a convention of architects and engineers assembled from 67 countries. Other brief reports were received via Alumni Fund envelope news panels: **John Houpis** has moved to a 55-acre citrus fruit farm which now keeps him busy. His new address is: 7 Periantron St., Corinth, Greece. He reports that he and Kiki are enjoying good health. Their son, Basil, is attending Miami University, Oxford, Ohio where he has enrolled in Naval ROTC (as did John). . . . **Sidney Brown** says that he and Sydney found themselves in London, England last June where they met with Rose and **Maury Beren** for a pleasant weekend. . . . **Walter Ridley** has retired from Foxboro Company in Massachusetts and is now a consultant for J. P. Stevens and Company. . . . **Grier Armstrong** retired from duPont Pigments Department at the end of October, 1970. . . . From **Alexander Daytz**: "I retired on October 1, 1970. On December 1, 1970 my daughter-in-law, Florence, with some help from my son, Robert, gave me a grandson, Mark L. Daytz, to carry on the tradition of the Daytz family. He is my fifth grandchild. Robert is a schoolteacher. With gym work, golf, extensive reading, and lecturing on world and national problems I am busy and enjoying my retirement; so is Dorothy."

A note from Alice and **Slim Maeser** tells us that Slim was hospitalized five weeks for surgery but is doing all right now. Since retirement he has been busier than ever. He is one of the library trustees and concerned with new building plans. Their daughter, Doris spent last summer in the Near East but got home in time to avoid the hijackings. . . . In a note from his wife, Verna, we learn that **Rudy Slayter** worked prodigiously for three months last summer building a lake cottage in mortar and stone. Verna avers it will be there when this generation and the next have passed into oblivion!—**Walter J. Smith**, Secretary, 209 Waverly Street, Arlington, Mass. 02174

## 30

This month we have a rather extensive report from **Bill Ailing**, one of two of our classmates who have made the very interesting transition from engineering to the ministry. After graduating as a chemical engineer Bill went to work for Industrial Rayon in Covington, Va., and began attending the local Presbyterian Church. His church attendance in Covington had a profound effect on his outlook on life. He "soon realized that the preaching in the south was far different from that in most northern churches. They taught that the Bible was historically true, and proved it. They showed me that Jesus Christ was truly God, and He had been crucified for the sins of God's people, and that I was a sinner,

who could have his sins forgiven if I believed these things. When I did believe it, my whole outlook on life was changed."

In 1947 Bill resigned from Industrial Rayon and went to Faith Theological Seminary in Wilmington, Del., to study for the ministry. He was ordained in 1950 by the Bible Presbyterian Church and his initial pastorate was in Canon City, Colo., where he remained for 6 years. He then became principal of the Cono Christian School in Walker, Iowa, for more than 10 years. After another year in pastoral work as Assistant Pastor of the First Bible Presbyterian Church of Indianapolis, he is now teaching at the Westminster Christian Academy, which has about 200 students and is affiliated with the Reformed Presbyterian Church of Huntsville, Alabama. He is teaching math, science and Bible in grades 5 and 6 and New Testament Greek in grades 7 and 9.

**Bill Wye**, as previously reported, is a Patent Examiner in the U.S. Patent Office. His hobbies include "learning golf and trying to determine which direction the stock market is trending." He reports having recently seen **Jim George**, who is teaching math and applied mechanics at Montgomery Junior College, Maryland and **Fred Turnbull** who is a patent attorney in Washington. . . . **Morris Young** is in private practice as an ophthalmologist in New York and recently was placed in charge of ophthalmology services at the Beekman-Downtown Hospital. He has written a number of books, the latest of which deals with ideas for science fairs. The Youngs' daughter Cheryl graduated from Finch and is now attending the College of Business Administration at Columbia University majoring in International Finance. Their son Charles is a pre-medical student at the College of Emporia in Kansas.

**Charley Abbott** is executive vice president of N.E. Gas and Electric Systems and has numerous extra-curricular jobs, among which are: member of the Lexington town meeting; chairman of the Planning Board for 5 years; vice-chairman of the Board of Appeals; trustee and member of the Board of Investment of Cambridgeport Savings Bank; corporation member of Symmes Hospital and Lexington Savings Bank; and president of Phi Beta Epsilon. The Abbotts have three children: Charles, Jr., M.I.T. '53, who is with Procter and Gamble in Cincinnati; William, Harvard '60, Harvard Law '63, and now practicing law in Boston; and Suzanne, Wheaton '67. Charley gives **George Wadsworth** quite a build-up for his "contribution to real, solid American citizenship" and says he wishes more college professors were like George.

**Dick Wilson**, as many of you know, is manager of film manufacturing at Kodak in Rochester. He is president of the Genesee Figure Skating Club and active in fund raising for the Rochester Community Chest and Rochester Museum. The Wilsons' son Stewart holds a B.S., M.S. and Ph.D. from M.I.T. and works for



the Polaroid Research Laboratory on the learning process. Daughter Suzanne has a B.A. from Radcliffe and is married to a Harvard lawyer practicing in Pittsburgh. . . . The **Ed Nolans** are spending the winter months at Palm-Airy Country Club, 3001 South Course Drive, Pompano Beach, Fla. . . . **Tul Houston** has just been made president of the Newark, N.J., Board of Realtors. He is also vice president of the National Society of Industrial Realtors. His son David, Jr., graduated from Dartmouth in '67, spent 3 years in the navy and is now studying for an M.B.A. at Columbia University "so he can take my job." Daughter Cindie graduated from Hollins in '69 and is now at B.U. graduate school. . . . **Ed Huson** retired in February. He is devoting his time to tinkering with his collection of early American clocks as well as re-searching, lecturing and writing about them. He is treasurer and a Fellow of the National Association of Watch and Clock Collectors, Inc. . . . **Homer Davis** retired from the army in 1963 after 30 years' service and immediately joined the staff of Stanford University. . . . Changes of address: Thomas M. Emery, 1955 Stanley Blvd., Birmingham, Michigan 48009; Prof. Jules A. Larrivee, General Delivery, Corvallis, Oregon 97330; Rev. Vincent I. Thormin, R.R. #4, Box 12 East, Stouffville, Ont., Canada; Rev. William M. Alling, 4000 Marie Avenue, Apt. B., Huntsville, Alabama 35805.—**Gordon K. Lister**, Secretary, 530 Fifth Avenue, New York, N.Y. 10036

## 31

A most welcome note from **Bob Martin** tells that his wife and he are going island hopping around the world below the equator. Of the world's islands, their fortieth will be Reunion Island in the Indian Ocean from which they will rush home for the 40th reunion. I hope you both enjoy the trip. Your envious classmates will be looking forward to hearing about it in June. . . . Charlotte and **Ed Hubbard** report that they had a wedding in the family in July when their daughter, Gail, married John A. Heidt. In November, Ed and Charlotte took a quick trip to Bermuda to celebrate their 40th anniversary and had a grand time. Congratulations to you both. . . . Word from **Art G. Fuller** says that he is still running their greenhouse insecticide business of Fuller System, Inc. in Woburn, pioneering new developments in smoke generators and fogging concepts. Art, also, is planning to attend our 40th reunion in June.

**Henri B. Turner** writes, "My position is now Chief Methods and Systems Analyst with the State Department of Public Works. Over the past three years we have produced eight volumes of *Standard Operating Procedures* which was a monumental task but has been very rewarding. Copies of our volumes are in use in Puerto Rico, Hawaii and about 25% of the States on the Continent. Hope to retire within two years." . . . **Ed Norris** was recently elected president of the Maine Association of Engineers and, also,

vice president of the Pine State Savings and Loan Association of Portland. . . . According to **Francis Weeks**, he is retiring from Joslyn Mfg. and Supply Co. at the end of 1970 after 40 years of commuting back and forth to the office. He expects to be busy making something of his travel pictures taken during eleven trips overseas in as many years.

**Ken Jamieson's** company sponsored a meeting, moderated by Frank McGee of N.B.C. News, between three student reporters and Ken with two other top members of his company on the subject of "Does the Corporation Have a Conscience?" From all reports it was extremely well received. . . . **Don Grieco** reports that the three regulars, **Gabe Cristofalo**, **Irving Finberg** and himself are looking forward to spending the winter in Florida again this year. During the 40th reunion, I hope they will give us a full report on their antics—which I understand caused a few raised eyebrows last year. . . . Via Ham Radio, Colonel **Fred Elser** reports all is well in Palm Springs, Calif., where he spends considerable time hamming and Mardy "bridging".

Since your last notes, the following deaths have been reported: **Harry A. Parris** on October 15, 1970, **Edward M. J. Pease** on September 25, 1970 and **William Volante** on January 17, 1968. Our deepest sympathy to their families.—**Edwin S. Worden**, Secretary, 35 Minute Man Hill, Westport, Conn. 06880

## 32

A note from **Joe Welch**, Oak Lodge, Navan, County Meath, Ireland to Ed Nealand reports that "Things are going along well over here and the fall weather has been superb up until the last two days. The horses haven't been cooperating by producing any wins for us and we are in the process of culling out some of the more disappointing ones and replacing them with some with which we hope to have better luck. I had a note from Tom Sears who was over here with friends on a short trip, but unfortunately he wasn't able to adjust his trip to include a few days with us."

Another note to Ed, this one from **F. Rolf Morral** of Columbus, Ohio. "Your letter arrived just as I was leaving town. My trip was somewhat hectic. I got caught in a couple of strikes—one at the University in Cordoba where we were meeting and where we were locked in for a couple of hours on two days and in a 36-hour general strike in Buenos Aires. I gave a couple of talks at the Cordoba meeting and showed a couple of films, one was a historical film on 'La Farga Catalana' which I picked up when I was in Spain. I gave a talk in Buenos Aires, two in Rio and two in Sao Paulo."

We regret to report the death of **Ralph M. Carpenter** of Lebanon, Conn., on September 22, 1970 and of **Lawrence M. Hubbard** of Wethersfield, Conn., on December 30, 1969—**Elwood W. Schafer**,

Class Secretary, M.I.T. Rm. 13-2145; **James Harper**, Assistant Secretary, 2700 So. Grant St., Arlington, Va.

## 33

First, we must repeat that this job is far from thankless, as witness the dozens of cards and messages that came to us at Christmas time. Many thanks, fellas and gals, though this may seem belated.

In the February issue we mentioned that we did not see **Henry Kiley** because he was sick. It turns out that he had a quite popular complaint: bronchial trouble. So did I, so we have no trouble in making with the sympathy for old Henry, who now tells us that he is OK again. . . . From Germain and **Jack Andrews** we get the annual message to family and friends summing up the past year. Germain is still busy teaching and is active in running the Princeton Skating Club. Jack avers that he still has his nose to the highway grindstone, but has time for his various and sundry hobbies: tennis, skating, groundskeeping et al. What a family of children they have! Johnny took a year off from college, and took a job in Denver, but will return to school this winter. Brother Jamie has graduated from college and is teaching in Colorado, near Johnny. Gail has come home after eight months in Switzerland, having solidified her background in French and skiing, and is nursing in Philadelphia. Gwen is still a secretary in Boston, but has an added feature; she is working towards a Master's at Harvard. Last but surely not least is Valerie, who is a Senior at Beaver College, Colo. Golly, what does Colorado have to draw three of the five youngsters? Well Sir, the Andrews attended a wedding in God's country this year, East Barrington, N.H., and almost stopped off at Fort Rock Farm for a visit. I might be better off not knowing this from Jack. Anyway, he promises that it will not happen again, and next time will allow more time for calls. Many, many thanks, Jack and Germain; we look forward to this fine annual letter.

Not to be outdone, the **Horace MacKechnies** come through with a similar letter. Last April they took an American Express tour of ten Western European countries. Showing that M.I.T. men are intrepid and adventuresome, Horace and Prue tried the Arlburg Pass in April. This one gets you from Innsbruck to Lucerne. And, they ran into the inevitable snowstorm. Since then, Horace has had some back and leg trouble but is gradually making it. He is still with the Department of Defense, Value Engineering. Horace's civic work consists of the Civic Association of which he is vice president. Prue is co-chairman of the Church Circle. While on a trip to move daughter, Joan, from Chapel Hill to Atlanta, they visited nephew, Eliot, who is in Rabun Gap, Georgia, where he is active in "Foxfire", which is apparently a school. Perhaps Horace will elaborate. Joan will work for her Master's at Emory College, where she continues her training in nursing under a

Federal training program. Horace's back trouble seems not to hinder his physical therapy; making a fence complete with gates on both sides of the home property. With the happiest of New Years to all of us, that is all from the faithful MacKechnies. Best wishes and many thanks to you and Prue, Horace. We enjoy your letter more every year.

**Cal Mohr** again takes the lead in grist for the notes mill, with two letters and lots of tidbits: **Ernst Spannhake** is an executive with the Singer Company now in Cleveland. . . . Cal asked for news about Christine and **Emmy Norris**, and I informed him that I saw them several times these past few months and both are fine. . . . Cal asks if I have any record of classmates who might have attended the Half Century Convocation of Chemical Engineering at M.I.T. No, Cal, either none were there, or none will write. However, two men, graduate degree fellas with 1933: Professor **Edwin Gilliland**, head of the department, was a participant, and **George Vila** was on the sponsoring committee. . . . Gleaned from the Chicago meeting of A.I.Ch.E. in early December is the following: **Win Partridge** is retired, and living in Texas City, Texas; **Bob Dillon** is production manager of Union Carbide in same city; **Gerry O'Connor** is in commercial development with Monsanto Biodize Systems, Inc.

A Christmas card from Ruth and **Bob Timbie** sends word that they are again planning to go to the Mexico City M.I.T. Club Fiesta. Great, folks, I hope to see you if I make it, as I plan. . . . Another card was received from Doris and **Gene Cary**, of Aurora, Colo. As has been reported here earlier, Gene is almost totally immobile. He is in a nursing home where he can get the care he requires, situated right near his home so that Doris can visit easily. There never appears to be any sort of complaint, in spite of a real tough situation. Any of you fellas that knew Gene as a student might well spend a few minutes sending him a card or nice letter. I just love to hear from you Gene and Doris, and many thanks from us all. . . . From **Raymond Smith** comes a post card, dateline Paris, telling us that he is on a business trip involving some international licensing stuff, which must be for the American St. Gobain Corporation (according to the Alumni Register). Ray was one of our boys in Course II, ME, long ago. He says that he does a lot of moving around, as he had just returned from Manila, Taiwan, and Japan. Ray signs off his picture card of L'Etoile and L'Arc de Triomphe, with Christmas greetings in French, which I do understand but won't admit it. Ray, I do wish that all travellers would send me a card, one each per trip. I would never have to go out and beat the bushes for Notes material; thanks a million.

Here's an annual letter, with card, from Marcia and **Charlie (Red) Payne**, of Rochester, N.Y. I do not recall ever having heard from them before, so the message is more than doubly welcome. Red, it seems, is now full time superin-

tendent of the Paper Mills Division of Eastman Kodak. (I hope that he keeps track of the other two characters in Kingsport, Regan and Stevens. Reading the letter makes one wonder when Red gets anything done at Eastman, as the two beavers are very active in extra-curricular work. They are both intensely interested in foreign exchange students, as Red heads the Rochester International Friendship Council Committee, which provides friendship families for foreign students in this country. Marcia augments the work of the Rochester three-cities-exchange program, with some additional work along the same lines. This program is, apparently, part of Red's committee work, and involves Rennes, France, Warburg, Germany, and Caltanissetta, Sicily. In 1970, Marcia flew to Europe, and visited all three of these cities, plus Istanbul, and parts of France other than Rennes. Late May found the two on a three-weeks' vacation to Belgium, France, and Switzerland, always with the Committee work in mind. Summer sees the Paynes entertaining the various exchange groups around the swimming pool at the Payne home. Last September they celebrated their 37th honeymoon by taking the second Kodak three-week charter flight to Greece, Turkey, and a week in Venice. When the April issue comes out, we hope to have a short listing of the Payne family, children and grandchildren, to complete this picture. To quote from Marcia's message on the card, "Red and I count our blessings, as we think back upon our year, and know how happy and blessed we are; in love for one another; with our fine family of sons and daughters, and, five grandbabies; with our friends from near and far; and for them all, we are more grateful than for the material things with which we are fortunate." I submit that this is one of the loveliest paragraphs we have ever been privileged to read. Many, many thanks, Red and Marcia, for thinking of us. Please make this present effort the very first of many just like it.

Now, a salute to one of our very best classmates and loyal Alumnus **George Henning**, and his most lovely Lucy. The Henning Christmas card, family edition style, consists of 20 photos on one side, with a resume of the Henning travels and fun for the year. The other side presents the family Christmas greetings, and an astounding photo of a very large wave, breaking back on itself in beautiful full color. The Hennings did get around: Hawaii, Puerto Rico, and California, mainly visiting the family, and just visiting. Two of the Henning daughters are married, and we now find Janet, the only one left in the single state, graduated from Pine Manor in June, and now a Junior at the University of Colorado, where "she is mountain climbing, skiing, and stargazing." Georgie managed a trip to a bankers' convention at Boca Raton, Florida, two miles from us. This, my good readers, is the salute to the Hennings for their usual fine job of reporting the year to us. George and Lucy, my thanks, and those of all of us, to you two remarkable

people. Please keep this up for many years to come.

**Don Fink** and his lovely Sally have sent us wishes on the anniversary of the birth of Christ. I can't forget that it cost me \$8.00 at the Coliseum to look for Don (AIE&E show). I was told that he was there. Thanks, Don and Sally, for remembering us. . . . Now from Alumni Fund Capsules we hear from three of our classmates: **Fred Aldridge**, **Allan A. Hinkle**, and **Richard D. Payzant**. . . . Fred has just recovered from what was diagnosed as a fatal illness, and appears to be quite thankful, and is now seeking "new challenges in the area of environmental and consumer protection." He asks for suggestions, hence the quote. An admirable purpose, and I must add that I have a fond hope that they do something and not just run the subjects into the ground with too much repetition. Go to it, Fred. I know that you, of all of us, is sincere. . . . Dick Payzant announces that he has just retired from the U.S. Civil Service, after 34½ years. Now, what the heck did he do with the other half year? Dick's card shows that he has worked in many places: Arizona, Merritt Island, Florida, Huntsville, Ala., and now St. Charles, Illinois. Dick's full story will appear later, if, he replies to my forthcoming letter. I just can't quote or understand, even, all these alphabetical agencies. We appreciate hearing from you, Dick, and will be pleased to elaborate. Many thanks. Al Hinkle was even more brief, with only a wish that his contribution could have been more beneficent. Thanks for the bit, Al.

The alumni register reports only two address changes: Professor **Francis T. Hall, Jr.**, Course VI, and **Outerbridge Horsey**, Course XV. I do hope, sometime, to hear from our Horsey, direct. These address changes are available, via the mails, if the request includes a short, timely, family blog. This last is a must. This is all for this time around. See next installment, which will feature a heck of a lot of news from Cal Mohr. (I have promised him top billing!) This last bit is written January 4, so again a Very Happy New Year.—**Warren J. Henderson**, Secretary, 1079 Hillsboro Beach, Pompano Beach, Fla. 33062

## 34

Your secretary is obviously in need of a better filing and follow-up system. With all the pleas that go out for news, it's a fine thing when I mislay a letter that not only tells about the writer, but gives us some information about two other class members. But if you don't file well, "squirrel" instincts are the next best thing. So the errant letter, written by **Bob Frazier** last August, has come to light. With apologies to him for the delay, here is his letter: "As to myself there has been little change since my last report. Like yourself am enjoying retirement immensely. Do a little substitute teaching in math at the local high school to keep me out of mischief when school is in ses-



sion and they are short-handed. My math isn't modern, but actually there hasn't been as much change as some would have you believe. The trick is to get at least some participation by a few members of the class and a discussion of the "Why" of the statements. In spite of the lurid publicity with which we are continually faced, I feel that a large majority of the young people are OK.

"As to others of the Class of '34, **Paul C. V. Grueter**, Course I, retired last spring after 36 years of civilian and military duty with the Corps of Engineers, spent mostly in New England. I understand that Paul is now associated with one of the consulting engineer firms in Boston.

"**Reuben M. Haines**, also Course I, is Chief of the Foundations and Materials Branch for the Corps at Waltham, Mass. If memory serves correctly, Reuben has worked on the original Passamaquoddy Tidal Development Studies in the FDR era and also worked on the St. Lawrence Seaway, as well as numerous military and civil works projects throughout New England."

Back in December I included a letter from Agness Lucke mentioning that Lee and **Ed Chiswell** had moved to Belgium. Now, via the Alumni Fund returns, comes a note from Ed himself. "We spent one vacation tour in 1970 on a trip to East Africa and can highly recommend it as the way to see wild animals. In August we moved to Brussels where I am still employed by Chevron Oil Europe." . . . Another traveller was **Russell Hastings, Jr.** He writes, "Attended the International Standards Organization meetings in Ankara in September 1970 as one of the two U.S.A. delegates for Packaging Dimensions. We are seeking world agreement for transport-package and unit load sizes that will more economically fit and interchange between all modes of transport—such as truck-trailers, freight containers (for ships, etc.), railroad boxcars, and hopefully, air cargoes. I would like to hear from any classmates with useful inputs. The city of Ankara surprised me by its modernity and rate of growth—population, now 1.3 million as compared to 25,000 just 50 years ago." Although Russ mentions only "classmates" I would guess he'd equally welcome comments from any other alumni who might read this. If any one should want to write him, he is with the Clark Equipment Co., Battle Creek, Mich.

Also from the Alumni Fund comes a note from **Charles F. Hill**. Charlie writes, "Took an early retirement from Massey Ferguson Ltd. after 18 years in the U.S., Brazil, Europe, and recently, the Canadian headquarters to pursue a manufacturing interest; and with a group of associates have formed the Temperform Corp. in Novi, Mich., near Detroit. Our company makes steel castings by shell and other specialized molding techniques." . . . Last year this column carried several reports on **Jerry Raphael's** professional activities. This time,

happily (and one of the items sounds especially happy) the news is more personal. He says "I remarried in March of this year to Ruth Molander Sells. The last of my youngsters, Steve, is a firstie at Annapolis—and captain of the Shields sailing team. I'm still sailing my Vanguard—and beginning to win races." It's obvious that the Raphael family is badly infected with sailingitis—from what I've read in the yachting magazines, the Bay sailing around Berkeley can get pretty sporty. . . . The final fund note, from **Jim Eder**, explains the address change I mentioned some months ago. Jim clears it up as follows: "I moved to Miami to devote all my energy (I have little) to making the best Air Boats and Hovercraft on this continent. It's a real tussle as we can't seem to find the good technicians that seemed to abound a few years ago. Anyway, it's fun to drive these craft over the Everglades, and we hope, over the snow." It sounds like Jim is having fun and we wish him well in his new venture. However, at the risk of sounding like an old grouch, I hope that when he goes looking for snow, he tries the West. Here in New England, problems are cropping up all over because of the big increase in snowmobiles.

Last month had a brief mention of Sylvia and **Ted Rimbach** and their new grandchildren. At Christmas Ted remembered me with a copy of the 1970 "Rimbach Review." It's full of family doings; in addition to the grandchildren there was news of: son Rich's election as treasurer of the Chicago Section of the National Association of Corrosion Engineers; daughter Nancy attending Luther College at Decorah, Iowa; son Don continuing two years of week-ends devoted to studying two of the major underground rivers in the Missouri Ozarks. Some of the results are due for publication in *Missouri Speleology* in mid-1971. Ted and Sylvia went on a long business-pleasure trip that took them to the Great Smokies, Winston-Salem, Washington, D.C., King of Prussia, Pa., and on to Boston for the Water Pollution Control Federation convention.

With all the words going around on this subject, I think Ted's comments in this area are worth quoting: "The water pollution control boom is a 'faint pop' so far because of severe lack of funds. Washington is slow to promote even what they promised, so most jobs sit waiting for some action. To give you some idea of the enormity of the problem, the public is going to have to vote favorably on bond issues (big ones) plus agitate for substantial increase in federal and state aid if we are going to do the job. Everyone is for pollution eradication but they must put their pocketbooks where their mouths are, and so far this is not the case."

Cal Mohr, '33, is once again almost as faithful to me as he is to his own class secretary when it comes to passing on news of '34 in the Chicago area. He had seen **Art Conn** at the annual meeting of the A.I.Ch.E. where, as president, the

latter was presiding. Cal found him in very good health but "busy as the proverbial paperhanger." He had also talked to **John Streng** who has given up his boat, but still winters in Florida. During the rest of the year he keeps busy with his work on recordings for the blind.

To wind up this month's notes, comes a card in to-day's mail from Winnie and **Ted Taylor**. This year they seem to have abandoned the Canary Islands for Mexico. Ted says "We are finding Mexico better than we had hoped for—every day sunny for five weeks now, friendly people, interesting history and archeology. Stayed three weeks in San Miguel de Allende with hot mineral pools for swimming. Now here (Mexico City) with great museums, ballet Folklorico, and much to see. Still have a dozen or more places to go but hate to leave each one. Happy New Year!" With the weather reports showing Portsmouth, N.H. below freezing for some weeks now, they certainly picked the right time to be in Mexico!—**R. M. Franklin**, Secretary, Satucket Rd., Brewster, Mass., 02631: **G. G. Ball**, Assistant Secretary, 4961 Allan Rd., Washington, D.C. 20016

## 35

When I received the following from **Samuel P. Brown**, I became so exhilarated that I could have written one of those "there is a Santa Claus" letters! "Why, Helen and I both do read your 1935 Notes promptly upon receipt of the Review. And, we do believe you; so here you have two letters! Two weeks from tomorrow I'll have a Director's meeting in Puerto Rico. Since it is on a Tuesday, we are going down the previous Friday—'cum' golf clubs, of course—and play again the West and East courses at Dorado Beach. We were sorry to read of your illness, and we're glad it is finally over. The Fiesta en Mexico is out for us, especially this year. The International Toll Bridge, Tunnel and Turnpike Association is meeting in Barcelona, Spain in October, and that takes priority position."

I have taken the following from Helen and Sam's Christmas letter: "We have a second granddaughter, Sharon Marie, born to our son Don and his wife Dorothy on May 20. She is now six months old and has big blue eyes and a slight suggestion of gold blonde fuzz on her head. Her adopted sister, Rita Joan, sixteen months, is a brown-eyed, curly haired brunette. This past Thanksgiving Eve, the legal proceedings were completed and Rita officially became their very own. Needless to say, these two little granddaughters are just the most wonderful! From Michigan, Joan and her husband, John Winston, made known recently that they are expecting a baby in March. John is in the doctoral program in mathematics at the University; Joan, at Christmas, is taking a leave from her job as a Systems Engineer for IBM. They just moved from their apartment to a ranch house in Ann Arbor. As for Helen and Sam—we stayed close to home this

summer and played lots of golf. In June, after a ten-month wait for an IRS ruling, the bulk of the business and affairs of Coverdale & Colpitts was turned over to Coverdale & Colpitts, Inc., Chairman—Sam Brown, '35; President, Ed Wemple, '34., Transportation & Industrial Consultants. The partnership remains for those few engagements requiring signatures by us as 'Engineers' or otherwise involving the practice of Professional Engineering. Then, in November, all of the stock of C&C, Inc. was sold to Madigan-Praeger, Inc. of New York City, which is a subsidiary of URS Systems Corporation, of California. We think this step of having 'joined a big one'—but a firm engaged 90 per cent in professional services—will be a good one for everyone in C&C and for our clients."

**John S. Cort, Jr.**, writes from Cleveland: "I came out of retirement this year. This summer I was involved in a special project for the City of Shaker Heights, in their Housing Bureau. Following that, I became Executive Secretary of a local Episcopal Church—a job that I find to be far from monotonous, and one in which I certainly meet a lot of new people. The financial workings of a large church are far from simple." John was formerly the Manager of the Agricultural Chemical Division of Diamond Alkali Company.

**Hal Everett** writes from Manhasset, Long Island: "With our two older offspring having finished college, we're still faced with a final year of prep school and then college for our youngest, Peter, now a Senior at Canterbury School. I am still active in my sales engineering representative and distributor business, but am doing an increasing amount of Industrial marketing consultant work, trying to move away from military electronics into industrial." Hal and Peter were at Homecoming Day last June on a tour of New England colleges.

Class President, **Bob Forster**, reports that **Randy Antonsen** has consented to take on the job of Class Treasurer left vacant when Art King found it impossible to accept his election of last June. . . . **William E. Keefe** is rejoining General Electric's Chicago office as an Electric Utility Application Engineer. Bill previously held this position from 1941 to 1953, except for a few years during World War II. Since 1953, he has been in G.E.'s Davenport Office working with the Iowa-Nebraska utilities as an Electric Utility Application Engineer. He also held the position of Manager, Installation & Service Engineering during his first nine years in Davenport. Bill has been with General Electric Company for 34 years. He served as Chairman of the Iowa Illinois Section of I.E.E.E. during his stay in Davenport and is a licensed engineer in Illinois and Iowa. Bill and his wife, Ruth, are pleased to be moving back to the Chicago area. They have a 14-year-old daughter and three sons, 18, 24 and 26. The two older boys have M.D. degrees and are interns; the youngest is a freshman in college.

The white snow I see as I write doesn't help me dream of golf, so I shall save everything related to our annual golf tournament until next month. By that time I will have played a few rounds in California with Ham Dow and Gerry Rich. I shall be prepared to give you stroke-by-stroke, hole-by-hole recaps of the torrid matches just in case the letter department is empty. In the meantime, I am off to New Hampshire with my family for a long ski weekend. No holidays this month—unless you live in South Boston and celebrate Evacuation Day and St. Patrick's Day on the 17th—and a happy March to you!—**Allan Q. Mowatt**, Secretary, 61 Beaumont Ave., Newtonville, Mass. 02160

## 36

Plan now to attend our 35th reunion at Jug End, South Egremont, Mass., in the Berkshires, June 4-6. The Committee met as the guests of Hal Miller at the Hilton Inn in Tarrytown. The plans decided upon have probably reached you long since in the reunion mailing. Sunday lunch was the order of the day. Present besides the genial host and your secretary were Mildred and Chairman Henry McGrath, Marian and Tony Hittl, Vivian and Eli Grossman, Phoebe and Frank Phillips, Peg and Fletch Thornton, Florence and Mal Graves, and Marian and Jim Patterson. The sixteen of us hope to see many of you in June.

A note from **Richard Lane** tells us that he is retired as director of engineering, Bendix Abrasives Division and is now director of marketing for Frank Bancroft Co., of Dearborn, Mich., still in the abrasives field. . . . The Reverend **Claxton Monro**, Rector of St. Stephen's Episcopal Church in Houston, Texas, since 1950 writes that although he has never been an engineer, his M.I.T. education has helped him in many ways to engineer the new church as he works for renewal in his congregation. He is the author of a book *Witnessing Laymen Make Living Churches* and will gladly donate autographed copies to the first ten classmates who let him know of their interest in the field. The Rector's home address is 2028 Dunstan, Houston 77005.

It is with sadness that I report the death in early December of **Robert E. Worden**. Services were held in All Saints Church in Wynnewood, Pa. Bob was a partner in Worden and Risberg, a Philadelphia management consulting firm. From 1936 to 1945 he was with the Campbell Soup Company. To his wife, Annette, son Geoffrey and daughters, Judith Nussbaumer, Pamela and Candace the Class extends its sincere sympathy.—**Alice H. Kimball**, Secretary, 100 Memorial Drive, Apt. 8-6C, Cambridge, Mass. 02142 or P.O. Box 31, West Hartland, Conn. 06091

## 38

The news is sparse this month, again because the printing schedule has been stepped up. . . . **Arthur Livingston** writes the following note: "I attended M.I.T. in the class of 1938 and in 1941 moved to Panama where I lived until 1968 when I moved to Florida permanently with my family. I suffered a stroke in February of this year (1970) and am just starting to learn to talk again." . . . **Charles C. King** writes: "Returned from five-year stay in France last year. Joined the Lummus Co. in Bloomfield, N.J., where I am Manager of Proprietary Sales and Licensing. Traveling back and forth to Europe more than ever." . . . **Miles Leverett** writes this note: "Am Manager—Safety & Quality Assurance for General Electric Nuclear Energy Division, 175 Curtner Ave., San Jose, Calif. 95125."

**J. David Baker** advises us that he is "still in Indianapolis where Hugh J. Baker & Company serves the construction industry with fabricated structural and reinforcing steel and related items. Just finished a three-year term on Board of Directors of National Association of Manufacturers; re-elected to Board of Trustees of National Council on Crime and Delinquency and serve as Chairman of Advisory Council to Commissioner of Correction for State of Indiana."

Don't forget Alumni Homecoming on June 6 and 7. We expect to have a block of seats for 1938 "At the Pops" concert. Bob Johnson is trying to formulate plans for a get-together on Monday night, June 7 for all of you who can get to Cambridge. You will be hearing more about this later.—**A. L. Bruneau, Jr.**, Secretary, Hurdman and Cranstoun, Penny & Co., 140 Broadway, New York, N.Y. 10005

## 40

Your secretary has received additional information in regard to the death of our president **Bob Bittenbender**. Bob died from lung cancer which was discovered very shortly before his death. He was born in Brookline, Mass., and after graduating from Tech went with Arthur D. Little, Inc., where he was a contracting officer for 19 years. Bob was active in boy scouting, served Minute Man Council in several capacities and was a member of the Lexington Historical Society and a senior warden of the Church of Our Redeemer. In addition to his wife Sally, Bob is survived by a son, Robert, a Quarter Master, 2nd Class, in the U.S. Navy, a daughter, Sandra, as well as his mother Mrs. Austin Bittenbender and two brothers, William and Donald. Jack Danforth made a contribution to the Mortgage Fund of the Church of Our Redeemer on behalf of the Class; your secretary wrote to Sally on behalf of the Class. Sally replied, "I certainly appreciated your letter of sympathy and it has been such a help to my children and me to hear



from so many friends in the Class of 1940. John Danforth sent a memorial gift to the Church of Our Redeemer for the Mortgage Fund in Bob's memory and the Vestry wishes to extend its thanks to the Class for that gift, and I too appreciate that memorial. It's hard to believe that Bob has gone. My memories of a wonderful, happy, loving marriage will give me courage to face the future, hard as it may seem now. Please remember me to your wife and thank you again for your thoughtfulness." A number of classmates have suggested that gifts be sent to Tech in memory of Bob.

I regretfully report the death of Lieutenant Commander **Paul A. Reynolds** on September 13, 1968. Paul was a member of Course XIX and resided in Waterford, Conn. at the time of his death. No further details are available.

From **Gary Wright** comes the following: "It was good to renew our acquaintance by phone today. The necessity for the call, re: Bob Bittenbender's death, was unpleasant. Bob and I were quite good friends and Sally, Marion, Bob and I spent many good times together especially the last year of 69-70. Bob and Sally attended our youngest daughter's wedding a year ago last August. Although Bob's passing was rather sudden, it was really a blessing that he suffered no longer. We are in San Francisco for another two weeks and then will return home—to farm and otherwise operate Wright & Assocs. Inc. All of our news is in the below letter and is better said by my wife, Marion: 'It's a balmy seventy degrees and winter and Christmas somehow seem sort of unlikely. But it is a good day to sort out the kaleidoscope of a year—a year of wonderful new beginnings and of nostalgic endings—a year of joyful hellos and throat thickening farewells—a year of frenzied activity interposed with restful moments—a normal year. First in order of importance in 1970 was the arrival of Christopher Matthew Burtner on March 13 in Anchorage, Alaska. We met Matthew in June when he accompanied Judy for a brief visit to Missouri. Words and pictures from Judy and Les from their little home in Anchorage assure us of his growth and development. We can hardly wait to see him again. Next in order was the acquisition of a tract of land on the Niangua River, north of here, named the Golden Spread. The new farm assures us that we will never run out of projects in our middle age. It's a beautiful wild spot and our hope is to husband our resources so that we may leave it productive again but still unspoiled. There were three important graduations in June. Gary received his M.D. degree from Yale in absentia since he was already en route to San Francisco for a pediatrics internship at Mt. Zion Hospital. He loves his work and is exceedingly happy. We will be spending Christmas with him and the rest of the California relatives this year. We attended the other two graduations at Radcliffe and Harvard where Janet and

# Reunions 1971

<b>60th</b>	'11	Oberlin S. Clark 50 Leonard Road North Weymouth, MA 02191	M.I.T. Campus
<b>55th</b>	'16	Ralph A. Fletcher Box 71 West Chelmsford, MA 01863	Chatham Bars Inn Chatham, Mass.
<b>50th</b>	'21	George Chutter Boulder Drive Box 305 East Dennis, MA 02641	M.I.T. Campus
<b>45th</b>	'26	Donald S. Cunningham 35 Talbot Street Braintree, MA 02184	Chatham Bars Inn Chatham, Mass.
<b>40th</b>	'31	Ralph H. Davis 66 North Street Lexington, MA 02173	Bald Peak Colony Club Melvin Village, N.H.
<b>35th</b>	'36	Henry G. McGrath 409 Wayne Terrace Union, N.J. 07083	Jug End (Berkshires) South Egremont, Mass.
<b>30th</b>	'41	Edward R. Marden Edward R. Marden Corp. 280 Lincoln St. Allston, MA 02143	M.I.T. Campus
<b>25th</b>	'46	Edwin Tebbetts N.E. Mutual Ins. Co. Actuarial Dept. 501 Boylston Street Boston, MA 02117	M.I.T. Campus
<b>20th</b>	'51	Jay Rosenfield 3 Bartlett Street Marblehead, MA 01945	Provincetown Inn Provincetown, Mass.
<b>15th</b>	'56	William S. Grinker 21 Woodward Road Framingham, MA	Harbor View Hotel Edgartown, Mass.
<b>10th</b>	'61	Dr. Jerome H. Grossman Massachusetts General Hospital Lab of Computer Sciences Boston, MA 02114	M.I.T. Campus
<b>5th</b>	'66	William H. Byrn, Jr. 995 Massachusetts Ave. Arlington, MA 02174	M.I.T. Campus

E.G. received their A.B. degrees magna cum laude. They then came home long enough to meet Matthew, see Judy, and store boxes of possessions. After a trip to Green Bay they left for Peace Corps training and two years in Senegal, Africa. They are happily adjusting to community work in the island village of Niodior. Two years will pass quickly but we miss them. As usual we travelled quite a bit. A brief ski trip to Vail, Colorado in February started us off. Then we spent a month in San Francisco visiting my mother. We had two restful, rejuvenating months on the beach at Kitty Hawk—May and September. We worked hard as usual but we also fished, walked, talked, and gratefully unwound. We were joined by various beloved friends and relatives. The plane has been sold. We miss the speed and convenience of air travel, but we are able to enjoy the beauty of the land more closely this way. We have discovered we are not in as much of a hurry as we used to be."

**Bruce Duffett** writes that he recently accepted a position as vice president of development for the Perry Plastics Co., division of Blasium Industries in Erie, Pa., and that it seems to be an interesting new challenge. . . . **Chester Livingston** notes that he is an airline operations engineer on the Lockheed L-1011 Tristar. . . . **Bill Peck** who joined Motorola Communications and Electronics, Inc. in June 1966, was transferred January 1, 1971 and promoted to national account executive handling Ford and Chrysler accounts. Previously he was industrial district sales manager in the Minneapolis-St. Paul area.

**Joe Greenburg**, a principal of A. T. Kearney & Co., Inc., a management consulting firm, was one of 200 Fellows honored by 40,000 of their colleagues who are members of the American Society for Metals for distinguished contributions in the field of metals and materials both in the United States and abroad. Joe's work has ranged from long-range planning, facilities and process planning to economic feasibility studies and market surveys for iron foundries, steel-making plants and other types of metal manufacturing facilities around the world. Joe and his wife, Edith, and their two sons, live at 6833 N. Kedzie Avenue in Chicago, Ill. . . . As a final, your secretary has just been advised that we still owe the Institute for our 25th Reunion as a result of which our already thin bank balance will be shaved in half.—**Alvin Gutttag**, Secretary, Cushman, Darby & Cushman, 730 15th St., N.W., Washington, D.C. 20005

## 41

**David S. McNally** has been named president and chief executive officer of Coleman Cable and Wire Company, 1900 North Fifth Avenue, River Grove, Ill. The company has twelve manufacturing facilities with sales totaling \$28,300,000



David S. McNally, '41

of electrical wire, cable and other products in its fiscal year ended January 31, 1970. Besides manufacture and distribution of cable and wire products used for power transmission, communications and basic electrical circuitry, the company product lines include plastic jacketed flexible steel conduit, solid state devices for communications, transformers, power supplies and high voltage corona-free connectors. Dave was formerly, since 1963, president of Amphenol Connector Division, a division of Bunker-Ramo Corporation, in which position he is reported to have contributed significantly to the growth of Amphenol into one of the world leaders in electronic connecting devices. In the early sixties, he also headed Amphenol's cable and connector system operations in the space and missile industry on the west coast. In a recent letter Dave states: "Anne and I have moved to the thirtieth floor of a high rise condominium overlooking Lake Michigan at the famous Oak Street Beach and truly love our new life style. Our bedrooms look west over the vast panorama of Chicago, almost to O'Hare Field. Our living room and dining room look east to the horizon of our inland ocean and southeast to the Indiana dunes. Son David is a first lieutenant with the Marine Corps, having achieved the flight rating of attack pilot. While detached for flight school to Reese Air Force Base at Lubbock, he was honored as the outstanding officer in his class for military leadership by the air force commander. He also trained with army infantry at Ft. Benning where he qualified as a paratrooper, and at Quantico where he served as lieutenant of marines. Daughter, Valerie, is happily married at Los Angeles, California where her husband, Eldon Barnard, operates car rental franchises."

**Joseph G. Gavin, Jr.**, senior vice president, Grumman Aerospace, presented a paper "Critical System Considerations in Designing for the Lunar Landing" at the ASME National Space Technology and Heat Transfer Conference in Los Angeles. Joe pointed out that at the initiation of the LM Program, one of the most difficult and challenging problems was that

of designing the vehicle for landing on a surface whose characteristics were virtually unknown. In conjunction with NASA, a series of "best guess" assumptions were made regarding the lunar surface characteristics.

Thus, coefficients of friction and bearing strength of the surface were specified to allow design of the landing gear pads. Maximum slope and maximum crater depth and rock height at the points of landing gear pad contact were assumed in order to establish the stability boundaries of the vehicle at landings. It was assumed that no visual determination of altitude and velocity near touchdown would be possible and an impact velocity design envelope was specified based on a purely IFR (instrument flight rules) landing. Finally, a descent engine thrust tailoff function was specified in order to establish the pressure and temperature regime of the landing gear and base of the descent stage, and thus to be able to provide adequate thermal protection and structural strength. The Apollo 11 and 12 lunar landing missions proved the LM design to be far more than adequate for the relatively "smooth" terrain tackled in those two missions. In terms of visibility, Grumman's IFR assumption turned out to be conservative on Apollo 11 since Armstrong had good visibility nearly all the way in. On Apollo 12, however, Conrad reported stirring up lunar dust as high as 300 feet and a complete loss of visibility at about 50 feet altitude.

Joe, therefore, feels the IFR assumption is still a good one for future missions, also that the first two lunar landing results were comfortably within design limitations, thus giving a high confidence that the LM can meet the more severe test of future missions.

**C. Arnold Kalman** has been elected senior vice president of Booz, Allen and Hamilton Inc. in which position he is responsible for the firm's services to the transportation industry. He is based in the New York office of the firm. He has been with the firm for 20 years serving clients in all areas of the transportation industry. He resides in Darien, Conn. . . . **Robert Wilson Blake** has left the National Bureau of Standards for a new position as chief of research and development at the New Hew Construction Agency and he reports ". . . they are working my head off."—**Walter J. Kreske**, Secretary, 53 State Street, Boston, Mass. 02109; **Everett R. Ackerson**, Assistant Secretary, 831 Cranford Ave., Westfield, N.J.; **Michael Driscoll**, Assistant Secretary, 63 Center St., Nantucket, Mass.

## 43

Defeated but not disappointed candidate **Dick Feingold** flew the Connecticut political scene in November to Puerto Rico. Jackie and I spent a wonderful weekend there on the 41-foot Hattaras fishing machine, "Carmen-Terre," with hosts **Tony Del Valle** and his lovely wife Carmen, and their two daughters for whom the vessel



is named. We rendezvoused at a secluded island off the east shore with some of Tony's yachting friends, and needless to say, the native food and drink and comradery was the greatest. Skipper Del Valle's construction company is engaged in some big and beautiful projects in the San Juan area, and these keep him pretty busy. At the end of our week's stay in Durado we had dinner with **Angel Gonzalez** and his sweet wife Ani. Angel is a partner in Puerto Rico's most prominent architecture firm, **Torre & Ferrer**, and is presently supervising the huge new Rockefeller resort hotel under construction next to Durado Beach.

Now that "show and tell" time is over, let's get on to the rest of the news. **Dick Henning** wrote, "Son R. E. (Rick), Jr. is a Tech man, class of 1972. I remember the day that many of us went to the infirmary to take physical exams for commissions in the Naval Reserve. I had no expectation that day that I would be writing today that I have just been promoted to Rear Admiral, U.S. Navy. It has been a good, challenging life, worthy of all that I could put into it." Congratulations, Dick, from all the class! . . .

**Robert Beatty** wrote that he is spending one year at Electrotechnical Laboratory, Tanashi, Tokyo, Japan, from March, 1970 to April, 1971. He is a member of the panel on marine communications and electronics of the U.S.-Japan cooperative program on natural resources. His address there is c/o Dr. H. Kashiwagi, Laser Section.

**J. Cooper Shackelford**, who did graduate work at Tech with our class, is the new president of the Carolinas branch of the Associated General Contractors of America. Beaumont Whitton, '33, of Charlotte, N.C. was kind enough to send us this news. . . . **Mrs. Maryalice Conley Moore**, who received her doctorate in chemistry with our class, has been made chairman of the chemistry department at Stonehill College in North Easton, Mass.

**Charles N. Satterfield**, a professor in Course X at M.I.T. who received his master's with our class, and later a doctorate, was recently appointed a member of the committee on air quality management of the National Academy of Engineering, and chairman of its ad hoc panel on control of nitrogen oxide emissions from stationary sources.

**Lew Geyer** wrote that he went back to school after leaving Moog, Inc. in 1967, and received his master's in 1968 and his Ph.D. in 1970 at the State University of New York at Buffalo. He is now an associate professor and acting chairman of the industrial engineering department there, and says he loves that new life.

**Gwynn Robinson's** company, Richard International, changed its name to International Market Management, Inc. Located in Century City, Los Angeles, the company services the American franchise industry through its offices in many countries around the world. Gwynn was

formerly president of Diners Club International. . . . **John T. Shutack** has been elected senior vice president of Booz, Allen & Hamilton, Chicago, with whom he has been since 1950. He is responsible for the firm's quality assurance program, as well as its manufacturing and distribution services division. As many of you know, this is one of the largest and most prominent management consulting firms in the world. . . . **Hamilton Herman** was named senior vice president, development, of American Can Company, and will be responsible for all new major business developments of the company, including acquisition planning.

**Ken Warden** and **Howie Mattes** discussed Thirtieth Reunion plans with yours truly at an Alumni Advisory Council meeting recently. Places mentioned were Bermuda, Puerto Rico and Nassau, as well as South Yarmouth on Cape Cod. Substituting for the Senior Class Secretary, **Jack Kelly**, is always a pleasure. Write him a letter and see what happens!—**Richard M. Feingold**, Secretary-Treasurer, 266 Pearl St., Hartford, Conn. 06103; **Jack Kelly**, Senior Secretary, 34 Scudder Rd., Westfield, N.J., 07090

## 44

Taking the men in alphabetical order, we have a note from **Richard H. Cavicchi** stating that he is now a part-time instructor in the Evening Division of Guyahoga Community College. Dick teaches physics and math. If he has a lab associated with the physics he must be very busy because I teach one night (Organization and Management) and it keeps me busy two others in preparation and grading of cases. . . . **Henry Cohen** writes that he is now Director, Center for New York City Affairs, the New School for Social Research. If he is working in the field of labor relations he must have his hands full with the several unions now on "slow-down" in the City.

According to an article in the *Milwaukee Journal* for October 1970, **Warren J. Harwick** is the new president of the Racine Hydraulics Division of Rex Chainbelt Inc. Warren has been with Rex since 1965 and has been in charge of research and development since 1967 as a vice president. Before joining Rex, Warren had worked seven years at G.E. in R & D and marketing. . . . We have a note that **James R. MacDonald** has been elected a member of the National Academy of Engineering and has been named chairman of the N.A.E. Numerical Data Advisory Board. Such membership is indeed an honor and Jim is to be congratulated. . . . I was pleased to note that **E. Alfred Picardi** had a feature article in *Modern Steel Construction*, Third Quarter, 1970. The picture shows Al's novel "tubular tower" construction for the new Standard Oil building in Chicago with his award-winning John Hancock building in the background. It will be the first steel tube within a tube building and will rank among the three tallest in the world. The scheme makes simple prefabrication

possible and proves that the weight per square foot is no longer an acceptable criterion for judging efficiency. Al is Vice President of Perkins & Will and works in the building right behind me here in D.C.

Two of the classmates used the back of their Alumni Fund envelopes to send news. **J. David Reeves** is President of Reeves-Clifton, Inc. which does business as Milex Precision Auto Tune Up, in Clifton, N.J. . . . **Walter W. Turner** comments that he has reached the college generation age with his oldest daughter Barbara a freshman at Allegheny College, Pa. He attended the reunion last June but the only classmate he saw was **Louis Demarkles**. . . . Another of our classmates who has been honored is **Stewart A. Washburn**, vice president and a member of the board of directors of Porter Henry & Co., a New York management consulting firm specializing in sales development. In an unusual move, the Institute of Management Consultants accorded him Founding Member status. Washburn attended the New England Conservatory of Music and is a licensed chemical engineer in the City. He is the firm's expert on the evaluation and operation of field sales forces and on the use of computers in managing such forces. Further he produces films for the firm's clients and has won two second prizes at the annual International Film and TV Festival.

OOPs, I forgot one letter forwarded by Paul Heilman. It is from **Samuel H. Lamport** noting that he left the responsibilities and security of 20 years at Lamports Co. to form his own applied textile technology firm, **TEX LAB, Inc.** P.O. Box 18018, Cleveland Heights, Ohio, 44118. He specializes in textile medical-surgical prostheses and synthetic fiber anti-friction materials. We wish Sam well in this new undertaking. . . . Drop your notes to—**John G. Barmby**, Secretary, IIT Research Institute, 1825 K St. NW, Washington, D.C. 20006

## 46

Remember the dates of the Class Reunion! It is now March and you have less than two months to make your plans for June 4-7, 1971. I had a scare on these dates the other day. We thought a high school graduation for our daughter, Lisa, would conflict, but fortunately Lisa will graduate on June 2, and the family will have time to attend the graduation and still drive to Cambridge on time.

As you are aware from the reunion mailings, plans are progressing well under the leadership of **Ned Tebbetts**. Ned's committee and their duties are divided as follows: **Jim Craig**, sleeping accommodations and catering service; **John Gunnarson**, yearbook; **Ted Henning**, registrations; **Ted Heuchling**, souvenirs; **Don Hurter** and **C. S. Lyon**, program; and, **Gene Parish**, publicity. The 25th Reunion gift has reached \$148,700.00 with our goal by June 30, 1971 set at \$400,000.00

A good note from **Fred Fuller** finds him in good health, and located in Elmhurst, Ill. Fred received his M.B.A. from Harvard Business School after graduation from M.I.T. The first 10 years after M.I.T. and Harvard were spent in sales and design of industrial automation equipment, both as an employee and entrepreneur. The last 12 years have been in the nuclear and scientific instrument field. Fred is now vice-president of Packard Instruments Company, a division of AMBAC Industries.

**Fred J. Ross, Jr.**, has written us from his home in Snyder, N.Y. (suburb of Buffalo), where he is a group vice-president of Abrasive Systems, Carborundum Company, Niagara Falls. The eldest daughter, Karen, is married and lives in Vermont with her family. She has made Fred a grandfather with her daughter, Wendy. Fred's son, Rick, is a freshman at Syracuse University where he is studying architecture. Another son, Jeff, is active in school activities and ski racing. Fred has just returned from an "Innovation Group" tour with M.I.T. Professor Don Marquis and 40 business executives. The tour was handled and coordinated by classmate, **Ford Park**. . . . From Pensacola, Fla., we received a card from **W. F. "Bill" Scheller**. For the past 13 years Bill has been an aerospace engineer (aircraft powerplants) with the Naval Air Rework Facility at Pensacola. Bill, his wife, and the 3 children Bill reports are fine. The boy, 18, is restless like most youths, but Bill believes he would like to become an engineer. The Scheller girls are 16 and 14.

**Nathaniel F. Rodman** has moved from the University of North Carolina to the University of Iowa as Professor of Pathology. His work has 3 forms. First is the teaching of freshman and sophomore undergraduate medical students, second is establishing a graduate research training program, and third, he is involved in thrombosis research—to use Nathaniel's words, a very challenging and exciting position. . . . **Marshall J. Corbett** is Director of Advanced Concepts, Grumman Aerospace Corp., Bethpage, N.Y. Jim, his wife and 3 children, live in Centerport, N.Y. Their daughter is a sophomore at St. Lawrence University while the sons, 15 and 13, of course, are at home. Jim is a member of the Huntington Congregational Church, the Centerport Yacht Club and has been active in the Boy Scouts.

**James T. Todd** is now with Union Carbide in N.Y. Jim's job is managing consultant in the management services department, an internal consulting group. The Todds have 2 grown sons, 1 now in the army and the other a student at the University of Connecticut. The third Todd child is a daughter, 8.

**Peter Sluis, Jr.**, his wife and 5 children are living in Wyckoff, N.J. The oldest son is enrolled at Covenant College near Chattanooga, Tenn. Due to the recent move of Shell Oil Company's corporate headquarters to Houston, Peter has accepted the position of general manager

at Triumph Decisions, Inc., a consulting firm specializing in econometric forecasting studies. . . . **A. Bruce Horton** has been appointed a vice president of Bell Aerospace Division of Textron. Bruce had been general manager of the New Orleans operations before this promotion. Bruce joined Bell in 1948, and he has successfully accomplished a number of development assignments in guided missiles, including instrumentation, guidance and overall weapon systems. Bruce participated in missile field testing in 1954-1955, and from 1965 to 1967 was manager of Bell's Arizona operations which provided more than 400 scientists, engineers and technicians for the operation of the U.S. Army's test facility and drone test range. Bruce has been in charge of the New Orleans operations where Bell is engaged in the development of a high speed surface effect ship (SES) that will skim over the water at speeds of 92 m.p.h. or more. A 100-ton research craft is scheduled for testing and evaluation during 1971.

**John A. Maynard** has sent us a brief note advising that his daughter, Cary, graduated from Wellesley in 1969 and is now married, living in Chicago, where her husband, J. Michael De Cenzo, is an intern in surgery. . . . **David C. Sherrick** has been elected vice-president, Marketing for Versiton, Inc., a Washington D.C. based manufacturer of communication equipment. . . . **John W. Taylor, Jr.**, has authored a chapter on the subject of receivers in a recently published "Radar Handbook." He has also received his 20th patent in the field of radar. . . . Please send a short letter telling of your activities so we may inform your classmates.—**Russ Dostal**, Secretary, 18837 Palm Circle, Cleveland, Ohio 44126

## 47

A simple note from **Walt Kern** could more or less typify the situation. His note reads "Business is terrible (Electronics)." In a way I know what he means as probably a lot of us are spending time at the first of the year on business and expense forecasts. I try to look more toward the real things but we are having a January thaw so that both skiing and skating are minimized. Despite conditions we plan to head to Western N.Y. this weekend as part of son Bob's 13th birthday celebration.

**Kermet Greene** has been appointed divisional general manager of the Sherman Division of St. Regis. In this capacity he will be responsible for all phases of sales and manufacturing and be located in Newton, Mass. . . . **Ben Craig** writes that he has forsaken the political arena. He was mayor of Florence, Ala., from 1966-1969 but chose not to run in the last election.

As Walt Kern says about business I must say that correspondence is worse. Why don't you drop a line?—**Dick O'Donnell**, Secretary, 28516 Lincoln Rd., Bay Village, Ohio 44140

## 48

At a meeting of the executive committee of the corporation held on November 6th, the following changes in personnel were approved: **Edward A. Mason** has been appointed to Professor and head of Department of Nuclear Engineering beginning July 1, 1971. **Walter L. Koltun** has been appointed to assistant director for resources, Harvard M.I.T. Program in health sciences and technology, beginning August 15, 1970.

One of our classmates, **Walter S. Bertaux**, has been promoted to General Manager—TF39 department in the Military Engine Division of General Electric Company's Aircraft Engine Group. In his new position, Walt has responsibility for providing programs of engineering, production, and logistic support for the TF39 turbofan engines which power the US Air Force C-5 Galaxy, the largest transport aircraft in the world. A native of Nova Scotia and raised in Brockton, Mass., Mr. Bertaux is married to the former Juanita Brown. They have three children and reside in Cincinnati, Ohio. . . . **Edward C. Mack** is living in Highland Park, N.J., and is the proud father of a three-year-old son. Nice to hear from you, Ed.

**Arnold H. Smith** and his family are enjoying life at Daytona Beach and would love any callers. Their son, Clark, is attending the Institute and took a leading role in last year's Tech Show.

After receiving a honorary L.H.D. from Starr King School (Graduate Theological Union, Berkeley, Calif.) **Michael J. Kami** decided to become "educated". He received his M.B.A. from F.A.U. (all this in 1970) and expects a D.Ed. in 1971. Accompanied by his wife Kay, Mike recently returned from an interesting trip covering Japan, Australia, and Moscow, U.S.S.R., while he also lectured on "floccipaucinihilipilification" in England, Italy and at Heidelberg, Germany. . . . A note was also received from **Lyman W. Morgan**. His job with Monsanto's Textiles Division is project managing of automatic measurement and control systems. The gadgets employed are usually called stream analyzers and dedicated computers. First of his five children goes off to college next year.

**Harold Hollister** owns and operates Cherrybend Pheasant Farm and hunting preserve and is also a consultant for Sperry Rand Corporation providing part-time representation at Wright Field in Dayton, Ohio. Harold and his wife, Mary, have two daughters. Best of luck, Harold. . . . **Carl Blake** has been elected the 1971 national lecturer for the Institute of Electrical and Electronics Engineers professional group on microwave theory and techniques. This position entails presenting a lecture to 15-20 chapters across the U.S. The lecture title is "Applications of Solid State Microwave Power Sources."





D. C. Sherrick, '46



W. S. Bertaux, '48



R. E. Lang, '49

**R. F. Trimble** stayed at the Institute for a Ph.D. in chemistry and taught at the University of Rochester for three years. Presently, Mr. Trimble is Professor of Chemistry at Southern Illinois University. One of his daughters is applying for admission to M.I.T. . . . **Eugene Purdum** of St. Petersburg, Fla., is in structural engineering, designing commercial and apartment buildings in steel and reinforced concrete and finding it challenging. Eugene finds his work very satisfying seeing his buildings grow to maturity.

The Ford Foundation has granted a Fellowship to the Reverend **George Swallow**, Rector of St. Luke's Church in New Orleans. The Ford Foundation Fellowship, in ethnic studies, will enable Father Swallow to complete his dissertation at Tulane University. It is the first such award made to an individual graduate student at Tulane University, and one of eighty-four made in the United States this year. While at St. Luke's Church, Father Swallow received an M.A. degree in history from Louisiana State University, New Orleans, in 1968. He is now a candidate for the degree, Doctor of Philosophy in history, at Tulane University. In addition to his pastoral work, Father Swallow has taught in high schools, at Brevard Engineering College, Melbourne, Fla., at Louisiana State University, New Orleans, and at Tulane University.—**S. Martin Billett**, Secretary, 16 Greenwood Ave., Barrington, R.I.

## 49

We start off this month with a news note which would have reached you last October except for a temporary failure in my filing system. In June 1970 **James A. Stavrolakis** was named president and chief executive officer of Glasrock Products, Inc., an Atlanta-based company which manufactures and sells \$11 million a year's worth of fused silica products to numerous industries. My thanks to George Fexy, '27, for sending me the original article and for reminding me when it did not appear. . . . Next, notes from Alumni Fund envelopes: **William C. Schneider** writes that he is still director of the Skylab program for N.A.S.A. . . . **Jabez S. Harford** is "still holding down

the fort in New York City for Niagara as is my old classmate **Larry Holt** in New England." Jabez is looking forward to a business-pleasure trip to Argentina this winter which should be a nice change from the six-day weeks he reports working of late, a result of the new pollution laws helping Niagara's business in many new areas. . . . **Linsey S. Ashley** reports a granddaughter born last July and "currently on duty with Naval Electronic Systems Command, Washington, D.C."

**John Alger** notes that his three children, a daughter age 16, and two sons ages 13 and 10 are enthusiasts on brass instruments. The daughter will go to Russell Sage next year. She spent last summer in Swaziland, South Africa as an A.F.S. student, living with a native family.

**Richard G. Alexander** reports that he and his wife, Sandy, flew to Spain over Christmas 1970 to visit their daughter, who is teaching in Jaén and to ski the (old, original) Sierra Nevadas. In a Christmas note from **Austin Marx**, we learn that he is in his 10th year at Hewlett-Packard where he is currently director, corporate planning and development. "We have a small group that looks at short- and long-term economics, long-range plans, technological and social change, and other interesting and exciting corporate activities." For extra-curricular activities Austin reports enjoying the Corporate Planners Association (president) and Peninsula Marketing Association (president last year). Last spring he participated in an American Marketing Association Annual Convention panel on "Corporate Planning's Interaction with Marketing" in Kansas City and in the summer completed a term as board member of the Campus Ministry at Stanford University. . . . **Richard E. Lang** has been appointed consulting scientist for Computer Systems Engineering, Inc., of North Billerica, Mass. Dick is a registered professional engineer in Massachusetts and comes to CSE from 14 years as a group leader and staff engineer for Raytheon Company's Equipment Division, following stints as project engineer with Arthur D. Little, Inc. and research engineer and teacher at M.I.T.

Since the last *Technology Review* column, I have learned that **Carroll E.**

**(Hap) Adams, Jr.**, was killed in Vietnam last May 12 in a helicopter crash which took the lives of General Dillard and eight others as well. The Generals' Selection Board had met in April and had submitted a list of 82 colonels for promotion to brigadier general. Colonel Carroll E. Adams' name was on that list. By authority from the White House, Hap was promoted to brigadier general forthwith. His burial services were conducted May 19 at the Old Chapel in the U.S.M.A. Cemetery at West Point with the full military honors due a brigadier general, just 26 days short of his 47th birthday. What a tragic loss. Our heartfelt sympathy to his family and friends.—**Frank T. Hulswit**, Secretary, 77 Temple Rd., Concord, Mass. 01742

## 51

**Henrik H. Bull** wrote that he was elected to Fellowship in the American Institute of Architects at their last convention. Congratulations! Any more of you 51'ers been honored recently? Please let us know if you have. . . . **Thomas Erber**, Professor of Physics at I.I.T. participated in a ten-part T.V. series aired on station WMAQ-TV entitled "Paradox of Progress." The series dealt with the confrontation between modern science and technology and human values. Thomas' part was concerned with patience: "In colonial times people routinely waited months for an answer to a letter, but now we often get edgy when we get a busy signal on the telephone." (Patience is the quality which our class secretary must possess by the gallon while he waits for class notes from me). . . . **George E. Groves** is with Sverdrup and Parcel and Assoc. Inc. in Jacksonville, Fla., where he is a general consultant on a \$130 million sewerage and water improvement program. . . . **Chuck Haeuser** writes that his life is architecture, children, church, reading, sailing, painting and travel. Some of his recent commissions included a museum, public library and housing for the elderly project. . . . Sometimes the news gets ahead of us. We have a note from **Edward A. Handy** from Chicago. He was a Senior Associate with Barton-Aschman Associates, planning and transportation consultants. We say "was" because a couple of months ago we re-



E. K. Matthews, '52    W. E. Sievers, '52

ceived a change of address for Ed indicating he was back in the Cambridge area. As soon as we confirm this, we will bring everyone (you & Ed) up to date.

**Michael G. Kesler** writes exuberantly that he is "FREE AT LAST." After receiving a Ph.D. from N.Y.U. he resigned as senior advisor at Standard Oil of N.J. and started the Kesler Computer Institute. He comes to work as early as he wants to and leaves as late as his wife will let him but at least he knows who he works for. Mike's wife Regina, is a graduate of Harvard Medical School and is a practicing pediatrician in Paramus, N.J. . . . **Eugene E. Koch** wrote from neighboring Whittier, Calif., that he is still Division President of Wards Co., Inc., but he is now operating out of the West Coast instead of Virginia Beach. Wards has major appliance departments in Zody's stores throughout Los Angeles as well as locations across the country. The Kochs have lived in five different houses in three years and hope that this house is more lasting. . . . **Kenneth H. McCorkle Jr.**, is still at Oak Ridge National Laboratory and is teaching chemical engineering part time at the University of Tennessee. . . . **Thomas P. Meloy** is in Falls Church, Va. He manages the Environmental and Applied Science Center for Mel Labs, a spin-off from Melpar. In his spare time he edits the *Journal of Ocean Technology*.

I am sorry to have to report to you that **Richard Armstrong** and **Steve Eisen** died this past year. I have no details of their deaths other than the dates. Dick was living in Middletown, New Jersey, graduated in Course XV and died September 20, 1970. Steve was living in Chicago, had also graduated in Course XV and died June 14, 1970 in an accident. I am sure the class joins us in sending their sympathy to their families.

**Russell W. Osborn, Jr.**, returned from Switzerland where he was general manager of Jarrell-Ash to become General Manager of Jarrell-Ash Division of Fischer Scientific Co. When he and his wife Rita returned, their oldest child started college while their youngest started kindergarten. . . . **William G. Rhoads** left Colombia in December, 1969 and is now in Montevideo, Uruguay. He

is the AID Representative there in charge of the U.S. economic assistance program to Uruguay. . . . **Howard Lew Schaeffer** wrote from Beaumont, Texas, but he is in Houston now. He is with the Sun Oil Company. . . . **Howard K. Smead** is general manager of the Special Systems Division of Control Data Corporation. . . . **H. C. Teubner**, SM XVI, a Brigadier General in the Air Force, is presently Deputy Chief of Staff, Comptroller, Headquarters, Air Force Systems Command in Washington, D.C. . . . **Charles W. Terrell** writes from Box 141A Route 1, Whigham, Ga. He is self-employed in the land development business. He also speculates in timber and cattle. He watches birds and has started bee-keeping as a hobby. He and his wife Margaret have a new home in the back woods. Since 1957 he has planted 270,000 pine trees. Wild quail nest in his yard. I look out and cut the smog to see. At least some of us learned something while at Tech. . . . **Alfred H. Wheeler** is a project engineer with the American Magnesium Company. . . . **D. C. Whittinghill, Jr.**, is manager of organization research for Campbell Soup at their Chicago plant. He coaches Bantam Ice Hockey, fishes in Vermont during the summer and plays as much golf and tennis as he can. . . . See you at the Provincetown Inn in June. Our 20th reunion should set reunion records according to feedback from the Alumni Office. This month's notes brought to you by—**Marshall Alper**, Assistant Secretary, 1130 Coronet Ave. Pasadena, Calif. 91107; **Howard L. Livingston**, Secretary, 358 Emerson Road, Lexington, Mass. 02173; **Paul Smith** Assistant Secretary, 11 Old Farm Road, North Caldwell, N.J. 07006; **Walter Davis**, Assistant Secretary, 346 Forest Ave., Brockton, Mass. 02402

## 52

**Lloyd A. Currie** has sent your secretary a card of season's greetings from Belgium. After eight years at the Bureau of Standards, Lloyd is spending a sabbatical at the Universities of Ghent (Institut voor Nucleaire Wetenschappen) and Bern (Physikalisches Institut). He writes that his research in nuclear chemistry relates particularly to the statistical interpretation of nuclear data and the study of low-level radioactivity and nuclear reac-

tions in the environment. The Currie family arrived in Belgium in September and he and his wife Barbara have enrolled three of their four children in Flemish (elementary) school. Lloyd says that education is taken quite seriously there and that even four-year-olds must attend school from 0810 to 1630 daily. The Currie children are rapidly learning Flemish and French and Lloyd hopes that they may do as well with German when the family moves on to Switzerland in the Spring. Lloyd sends his wishes for a healthy and peaceful New Year to all the class.

A nice long letter has come from **Ralph Stahman** describing his activities since graduation. Ralph writes, "After brief stops at Ethyl Corporation, Ford Motor Co. and General Electric's Jet Engine Division, I joined the Federal Air Pollution program in 1959 with the U.S. Public Health Service Laboratories in Cincinnati, Ohio. Since that time I have been in charge of various emission control research activities involving motor vehicle pollution. Our Division was moved to Michigan in 1968 where I now have a group devoted to test and evaluation of new emission control techniques and advanced low pollution power systems. We enjoyed participating in evaluation of entries in the M.I.T.—Cal Tech Clean Air Car Race as they passed through Detroit last August. As to family life, I married a Michigan school teacher in 1956 who has presented me with four daughters. She is understandably happy to be back in Michigan and the rest of us have learned to like it too here in the Ann Arbor area."

**Stanley I. Buchin** writes that he is now president of a management and consulting company, Applied Decision Systems, in Boston. The firm specializes in quantitative methods and the computer. Stan says that the Buchins have added a third child, Gordon, born in October 1968. . . . **James H. Bunting** notes that he is working as a Staff Engineer at Bowmar/ALI, Inc. in Acton, Mass. . . . **Earl W. Snell** received his Ph.D. from Stanford University in January 1970 and is currently teaching, as Assistant Professor of Management, in the College of Business, University of Utah. . . . **Yair Eisenberg**, his wife Marjorie and daughters Beth and



Becky, visited Israel, Greece and Italy last summer. . . . **Werner Kahn** has been transferred from Buenos Aires, Argentina to the Pittsburgh head office of Gulf Oil Corporation, where he is working on worldwide marketing coordination. . . . **Ernest V. Parziale** has been promoted to senior engineer at I.B.M.'s Components Division at East Fishkill, N.Y.

The Boston newspapers recently reported that **John R. Myer** was a member of a project team receiving a national "Award of Merit" for the design of Warren Gardens, a low income housing development in Roxbury. The award was presented by the American Institute of Architects National Center for Low and Moderate Income Housing, the National Urban Coalition and the Urban Design and Development Corp. . . . E.P.G. Computer Services, Inc. of New York has announced that **E. K. Matthews** has been elected president. Dr. Matthews is married to the former Mary Ellen Conway and is the father of three children, Carolyn, Stephanie and Brian. . . . **Werner E. Sievers** has been named by the MITRE Corporation to the position of Associate Technical Director of the Surveillance and Defense Systems Division. Werner, his wife and son Eric live in Woburn, Mass.

Some of our classmates are always mixed up in unusual doings. **Gus Rath** writes that for the last couple of years he has been teaching SCUBA and doing some research in that area. He helped arrange a successful symposium on "Engineering Psychology and the Free Diver" in the swimming pool of the Carillon Hotel during the American Psychological Association meeting in Miami.

**Paul Lux** notes that he is serving his second year as Secretary of the Independent American Whiskey Association. Paul has also been appointed to the presidency of the David Sherman Corp. He says that he has four children, two boys and two girls, and that he has been doing a lot of skiing in Colorado and in France during a ski club trip in January.

A newspaper clipping has been sent in by **Harold Roth**, who has been appointed to the new position of Director of Research and advanced development for the electronics division of the Allen-Bradley Company. Harold was chief of the electronics components laboratory of the NASA Electronics Research Center in Cambridge. He, his wife Lorraine, and their three daughters, Leslie, Valerie, and Stephanie live at 6166 N. Kent Ave., Milwaukee, Wisconsin.—**Arthur S. Turner**, Secretary, Lowell St., Carlisle, Mass. 01741

## 53

Your tardy class secretary once again apologizes for the absence of class notes in recent issues. . . . Where should we hold our twentieth reunion? This is a question which the class must consider and resolve over the next several months.

Should we hold it in Bermuda? I raised this question to the class in previous issues, and, thus far, there have been no negative responses. Jill Malloy has been the latest to support the Bermuda banner. Do we hear any other proposals? Since we are now at the half-way mark between reunions, a definite decision must be made within the coming months—by June or July of this year at the very latest. Stan Margolin, class of 1949, who was the recent reunion chairman for his class, reports that the Bermuda reunion was a definite success. He recommends that we definitely make commitments with the hotel in Bermuda at least eighteen months in advance. Stan reports that the total cost of the reunion, including travel expense from New York or Boston, will be about \$200 per person, or \$400 per couple. If children under twelve also plan to attend, their rate will be slightly less than half of the adult rate.

As the years move on, more and more of our classmates are gaining positions which allow them to have broader influence on their surroundings and, in some cases, on society as a whole. Some recent activities of special interest: **Herbert Richardson** has been recently appointed as Chief Scientist of the United States Department of Transportation under Secretary John A. Volpe, former Governor of Massachusetts. Dr. Richardson is now on leave of absence from the Mechanical Engineering Department of M.I.T. . . . **Gilbert Dewart** has actively been involved with the Institute of Polar Studies on a National Science Foundation-supported project to investigate the geophysical and glaciological characteristics in Antarctica and Alaska. Gil is now Assistant Professor of Geology and a Research Associate with the Institute of Polar Studies at Ohio State University.

**Ben Coe** reports that his V.I.T.A. activities have been successfully expanded to include a program for the United States, as well as providing overseas technical assistance help. The U.S.A. program, started in 1969, gives technical assistance to urban and rural projects.

**J. Robert Schrieffer**, Mary Amanda Wood Professor of Physics at the University of Pennsylvania, was elected a Fellow of the American Academy of Arts and Sciences at its 190th annual meeting in Boston. Schrieffer has become an internationally known theoretical physicist, whose work in developing the theory of superconductivity has become widely recognized. Also elected to the Academy at the same meeting were news commentator, Eric Sevareid; writer, Norman Mailer; and musician and composer, Duke Ellington. . . . **Fortney "Pete" Stark**, who has been a bank president in Oakland, Calif., recently received publicity for his advice to bank customers to cash in their United States savings bonds in protest of the war in Indochina. The United States Treasury did not take kindly to this advice, and cancelled the bank's per-

mission to sell United States savings bonds. Aside from the fact that savings bonds may contribute to the extension of the war, "Pete" claims that they are a poor investment, because other bonds pay higher rates of interest. . . . **S. W. Gouse** authored a timely and interesting article on "steam cars" in a recent issue of *Science Journal*. . . . **Mark Schupack** has recently been named Chairman of the Economics Department at Brown University. In 1969, Mark authored a comprehensive study on competition in the automobile industry which received wide attention in United States Senate subcommittee hearings.

**Martin Wohl**, formerly with the teaching staffs of M.I.T. and Harvard and later with the Rand Corporation in California, continues to make contributions in the area of mass transit. Marty is now Director of Transportation with the Urban Institute in Washington, D.C.

Special activities of note: **Paul Shepherd** was recently given a Presidential Citation from M.I.T. for his contribution in initiating and implementing a new program of seminars for young alumni on the West Coast. . . . **Burton Rothleder** was recently given a Certificate of Appreciation by M.I.T. for his alumni fund-raising efforts in the Pittsburgh-East area. . . . **Dick Chambers**, **Kenneth Fetting**, and **Betty Ann Lehmann** recently attended the 1970 M.I.T. homecoming.

At long last . . . **Alan Lazarus** reports that he got married on October 18. Alan was one of the few that I really held out hopes for, but now . . . **Al Hecht** is a pilot for United Airlines in San Francisco. During his spare time, he teaches at the local high schools. Al reports that his son has become quite a basketball player. . . . **Bob Godfrey** reports that he recently flew his new Cessna 182 to the Bahamas for a two-week vacation. How about a lift to the Bermuda reunion in 1973, Bob?

In the business arena, several of our classmates have made notable progress: **Bill Peet** has recently been elected president of A.G.A. Corporation, an affiliate of a Swedish company. . . . **John Walsh** has been elected president of York European Operations, a Division of Borg Warner Corporation. . . . **B. Edelman** is president of a company building electronic cash registers. . . . **Migel Garcia** is founder and president of a plastics company in South America. . . . **Justus Gilfillan** has been appointed president of Rancho California, which is a large real estate holding in Southern California jointly owned by Kaiser and Aetna Insurance Company. Before joining Rancho California, Gilfillan was president of Madonna Mountain Corporation in Vermont, a large resort-ski area owned primarily by the Watsons of I.B.M. . . . **F. Douglas Van Sicklen** was recently named president and member of the Board of XYZ Corporation of Newton Upper Falls, Mass. . . . **Paul Green**, who took graduate work at M.I.T., has recently been made manager of the newly

created Communications Sciences Department at the I.B.M. Research Center at Yorktown Heights, New York. Paul will be in charge of research programs in digital communications, techniques, and signal and image processing. In 1970, Paul was co-chairman of the 1970 International Symposium on Information Theory. . . . **Gene Richter** was recently made general manager of Marquette Metal Products Company, a subsidiary of Curtiss-Wright. Gene lives in Cleveland, Ohio, with his wife and three daughters. . . . **Sidney Gravit** is now manager of Ground Transportation, Transportation and Urban Systems Area, Boeing Aircraft Company.

**G. A. Wallace** is now director of marketing for Ecusta Paper Division of Olin Corporation in North Carolina. . . . **Bill Gent** is branch manager for Warner & Swasey in Tulsa. . . . **F. Patterson Smith** is now engineering manager with Microphase Corporation in Stamford, Conn. . . . **Dick Segien** has been named vice president—operations for a new subsidiary of Eastern Gas and Fuel, Eastern Urban Services, Inc. Eastern Urban Services offers a solid waste management system which is aimed at reducing solid waste pollution.

Among our classmates in the military: **Arthur Winquist**, now a Major, is with the First Air Space Cartographic and Geodetic Squadron at Forbes Air Force Base in Kansas. . . . **Gordon A. Beals**, also a Major in the United States Air Force, has recently been awarded a Ph.D. in atmospheric sciences at the University of Washington. . . . **John Roop** is now a Lieutenant Colonel in the United States Army and has recently graduated from the United States Army Command and General Staff College at Ft. Leavenworth, Kansas. John is now assigned at Ft. Belvoir, Va.

On the educational front: **A. E. Profieo** is now Associate Professor of Nuclear Engineering, University of California at Santa Barbara. . . . **John Nohel** has recently completed a two-year term as Chairman of the Department of Mathematics, University of Wisconsin.

The next issue will be concerned primarily with changes of address and further reports on reunion plans. Dick Lindstrom, our class president, plans to initiate reunion discussions soon, and so we plan to keep you advised of our progress. If you have any suggestions about reunion location, please let us know fairly soon.—**M. C. (Mandy) Manderson**, Secretary, c/o Arthur D. Little, Inc., 35 Acorn Park, Cambridge, Mass. 02140

## 54

**Bob Warshawer**, President of the Class of 1954, has asked me to take over the duties of Class Secretary, as you all probably know as a result of his recent letter. Only with your help can I fulfill my charge—that there be notes of the

doings of our classmates in each issue of the *Technology Review's* "Class Review." Therefore, I request that you send me news of your doings so I can properly report to all our interested classmates.

At this point, nearly 17 years out of the Institute, I find I have unfortunately lost communication with so many of my friends from Institute days: I urge you to re-establish communications through this column. Therefore, since my name, **Harvey Steinberg**, has not previously appeared in these columns, I will report on my doings since leaving the Institute. In June of 1954, I joined the Beacon Construction Company of Boston as a junior project engineer. From that time to now, I have advanced up the ladder until I am now a corporate vice president in charge of one of Beacon's operating divisions. I have had a great deal of construction experience over the years, building major projects such as water treatment plants, missile base facilities, radar station support buildings, regional postal mail handling facilities, warehouses, factory buildings, military personnel and family housing; and lately, garden apartment housing complexes. My profession has taken me to building in construction locations as diverse as Atlanta, Ga.; the top of Lookout Mountain in Tenn.; Crete, Nebraska; Rio Piedras, Puerto Rico; Waukegan, Ill.; Billerica, Mass.; Fort Leavenworth, Kansas; Oscoda, Michigan, etc. This, of course, has meant that my family has had to move at times with me—living in such locations as Cape Cod, Mass. in the wintertime, Charlotte, N.C. in the summertime, and Chicago, Ill. To date my varied career has given me a great deal of professional satisfaction. As for my family—in December of 1954, I married Arline Clepelle, a graduate of Emmanuel College, whom many of you will remember from Baker House days. Arline and I have two children—Brenda, 14, and Bob, 12, and a dalmatian, Caesar. We recently completed the construction of our dream house located on two acres in the western suburbs of Boston, which I designed and which my wife constructed as the project manager. Only one trouble with the house—too big. Therefore, we would welcome guests if any classmate is in the Boston area.

In my spare time, what little there is after profession and family, I am Secretary of the Massachusetts Chapter of the Associated General Contractors, AGC, and Vice Chairman of the Framingham Industrial Finance Authority, and have even managed a couple of appearances as a guest lecturer to graduate students in the department of Architecture at the Institute. In order to keep in shape and for relaxation, I play a great deal of tennis with my family and with my perennial tennis partner, John Savoca, '52.

Have recently heard from several of my friends: my old roommate, **Robert G. Wolfson**, who is now a professor at Dartmouth; **Joe Blake**, who is busy starting his own business; and **Herbert Slater**, whose wife Cookie is expecting, and,

who is now president of Slater Electric Company on Long Island. . . . The Institute has just announced that **Dean Jacoby**, who has completed five years as Director of the Office of Information Processing Services, OAS, will take a special assignment "to work out a better means for communication of policy and procedural information to the Institute community."

**Don Goldberg** and **Bill Zoino** are moving their practice in the field of soil and foundation engineering, Goldberg-Zoino and Associates, to Newton, Mass. . . . **Arnold Tubis** is presently Professor and Assistant Head of the Physics Department at Purdue University, dividing his time between teaching, research and administration. . . . **Raymond D. Mintz** is now director of systems and operations research in the Office of Planning and Research, Bureau of Customs, in the Treasury Department. . . . **Bill Hartrick** has just returned from Vietnam and taken over command of the 63rd Engr. Bn. at Fort Hood, Texas. . . . And, finally, if you ever get into trouble in San Francisco, I would advise contacting **Coleman Bresee**, who is a partner in the new California law firm of Friedman, Sloan & Bresee, specializing in criminal defense, while **Frederick R. West**, newly appointed research associate in astronomy at the Buffalo Museum of Science, reports that he "has obtained spectrograms of double and multiple stars at David Dunlap Observatory, Richmond Hill, Ontario, Canada."

It is apparent that our diverse careers have carried our classmates down their individual paths to the far corners of the earth following the relative commonality of our Institute experience. Follow your classmates' news in future columns and let your classmates know of your interesting wanderings by writing—**Harvey Steinberg**, Secretary, 273 Singletary Lane, Framingham Center, Mass. 01701

## 55

There aren't many signs of spring yet; even the prospects are cold. As a matter of fact, I've been thinking of giving up engineering and becoming a fuel oil dealer, just to get a discount. But I digress. . . . The management consulting firm of Booz, Allen and Hamilton has announced that **John F. Wing** has been elected a vice president of their scientific and technical services subsidiary. After completing his MBA at Harvard, John worked for Bethlehem Steel and Alcoa Steamship Co. before joining Booz, Allen Applied Research in Bethesda, Md.

**Stewart A. Bliss**, who is president of Kaman Sciences Corporation, was elected to the board of directors of the Colorado Springs National Bank. After several years at Sandia Corp., Stewart joined Kaman Nuclear, and later moved up the ladder at the Kaman corporate headquarters. He and his wife Shirley and their two daughters make their home in Colorado Springs.



When we asked Technology Review readers to compete for prizes in solving the October/November Tech-Crostic, over 130 rushed to the nearest post office with their answers. Some stayed up all night; some spent 35 minutes. Here's what some of them said:

I'm especially pleased to find mature articles on some of the social problems in this Technological Age.

I'm first

Damn good puzzle!

I hope

It took me 1 hr. 25 min.

I'm Posting this at 3.30 a.m.

there is so much to enjoy in Technology Review we read it from cover to cover.

I grab the magazine from my husband who enjoys all the scientific things you have to offer, so I can tackle your Crostics.

Made it more difficult - only 35 minutes this time.

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**Martin Raab** is an associate of the architectural firm of Haines, Lundberg and Waehler. One of his projects is the design of the U.S. Army War College. He is also a visiting lecturer at Columbia University, and he lists himself as a bona fide suburbanite. . . . **Frank B. Leitz, Jr.**, recently delivered a paper on piezodialysis at the Third International Symposium on Fresh Water from the Sea, held in Dubrovnik, Yugoslavia. . . . **Henry E. Theis** is completing his graduate studies for the M.B.A. at the University of Chicago. . . . **Lester Lee** has sold his wholesale liquor business in Washington, D.C. and he is looking for new worlds to conquer.

Last year two of your classmates added to their families. **Gerry Kliman's** second son David was born in June, and **Denny Shapiro** is the proud father of Zachary, born in October. Heartiest congratulations are extended, but I sense I may have to trot out the anti-male chauvinist lecture. He and Sue recently returned from a trip to England, France, Italy and Israel. And in an off-election year.

If you have recently delivered a paper or a baby, why not share the news with others by sending a note to—**Allan C. Schell**, Secretary, 19 Wedgemere Ave., Winchester, Mass. 01890

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Here we are, three months and counting to the island invasion day. Rendezvous at the Harborside Inn June 4-6, Edgartown, Martha's Vineyard, Mass. Get your code number and instructions by contacting Bill Grinker at Boston Computer Group, 15 School St., Boston 02108, phone 617-227-8634.

**Paul Abrahams** is visiting professor of computer science at Moscow University this spring. Also expects to spend a month (only we hope) at Novosibirsk University in Siberia. . . . Professor **Bob Carlson** is building a graduate school of management at Wake Forest University. . . . **Terrance Carney** is an associate professor of engineering at the University of Tennessee. . . . **Bob Clark** has recently returned from five years in Peru where he initiated research and engineering at Cerro's mines high in the Andes. Now he is back in the clouds doing strategic planning for I.B.M. . . . **Kreon Cyros** is trying to organize a consortium of universities who would share the planning systems designed by his group at M.I.T. . . . **Jim Dugelby** started Threshold Engineering Co. back in 1969 to provide services to the aviation industry but now likens his timing to 1929.

A recent slip of the pen in this article implanted the wrong initials on **Gideon Gartner's** firm, E. F. Hutton, and resulted in a full updating. Before joining the financial world, Gideon had worked with Systems Development, Philco and I.B.M. to develop the right background for explaining the computer industry to institutional investors. Let him do it for you at

the reunion. . . . **Chuck Gorman** is still director of purchases at Rogers Corp., Rogers, Conn. See him at the reunion.

**Nick Kiladis** has left Martin Marietta to become administrative assistant to the Congressman from Maryland's 4th District. . . . **Bill Peter** has been with du Pont in the Fibers Department since 1958 and is now Production Superintendent for Nomex fire resistant nylon. Bill, wife and four children live in Richmond.

**Norman Siegler** has left Xerox to be corporate controller of Ideal Toy Co. . . . **Reverdy Wright** is teaching computer science at Virginia Polytech.—Cosecretaries: **Bruce B. Bredehoft**, 3 Knollwood Dr., Dover, Mass. 02030; **T. Guy Spencer, Jr.**, 73 Church St., Weston, Mass. 02193

## 57

A number of items for your bedtime reading: **Don Norman's** wife Martha dropped us this note: "Don has been made a full professor in psychology this year at U.C.S.D. He's been writing text books in his 'spare' time—two have been published, and he's working on three others. We've been in La Jolla for four years now and still love every minute—no snow." . . . **Bob Rosin** advises us that he has been promoted to Professor of Computer Science at S.U.N.Y. at Buffalo. He adds: "The 'good life' is compromised by a continually deteriorating nation and world." (Perhaps Bob's depression is related to the snow in Buffalo.) . . . **Bill Griffin** is still at Northrop Corporate Laboratories heading research groups in fluids and heat pipes. . . . **Don Aucamp** received his Sc.D. in applied math and computer sciences last September. . . . **Virginia (Hermann) Thelin** writes that her husband is Chairman of the Sociology Department at Junghai University in Taiwan. They have two sons, aged 3 and 1, and plan to return to the States next summer after five years in Taiwan.

**Jim Cunningham** writes that their first child, a girl, was born on September 24, 1970. He is still in the information game—making display computers now at Imlac Corporation. . . . The **Michael Schmidts** sent me the announcement of the birth of their third child and first boy on September 26—two days after Jim Cunningham's girl. . . . **John Varela** sends us some news on other classmates: "**Paul Bauschatz** was married last summer to the former Cathleen McCollum. He is teaching English at the University of Maine after receiving his Ph.D. in English at Columbia. . . . **David Vaughan** is back East working for I.D.A. in Washington. . . . **Kim Seward** is still with I.B.M. on the F.A.A. project in Atlantic City. He heads I.B.M.'s Field Operations Office known as F.O.O. I'm still with MITRE, also on the F.A.A. project." Many thanks, John. . . . **Bob Kruger** writes: "I'm currently a Vice President and Director of a small firm (about 175 employees) engaged in con-

tract research. As Manager of the Theoretical Sciences Division, I am engaged in studies ranging from the response of solids to high pressure loading to radiation transport. My wife Donna and I have four fine, albeit noisy, children, one girl, and three boys."—**Frederick L. Morefield**, Secretary, Tiirasaarentie 17, Helsinki 20, Finland

## 58

We had begun to think **Mike Kenyon** had been dry-gulched somewhere in the Rockies but a letter arrived this month. "We recently were transferred from Ogden, Utah, to Glenwood Springs, Colorado, as Trainmaster for the Denver & Rio Grande Western RR and are enjoying being in the middle of Colorado's ski country. Jayme (Colorado College '61) and I have one daughter, Kristen (age 6), and one mixed poodle, Suzie, to keep us on the go!" . . . **Warren Heimbach** is now vice president—operations for Optigan Corporation, Compton, Calif., a Mattel Company. Warren, as most of you know, recently returned from 2½ years in England where he served as managing director of Mattel Limited.

**Les Sodickson** told us that he has left American Science and Engineering to form a new business in the field of medical diagnostic instruments.

**John Leonidas** was a founding member in 1968 of Technical Marine Planning Ltd. Overseas, a technical company engaged primarily in the design, construction, and operation of ships of various types. John's business address, for those of you who may be traveling in that area, is 123 Karaïskou Street, Piraeus, Greece. . . . **Frank Galeener** has received his Ph.D. from Purdue University and is now working in the San Francisco Bay area. . . . **William S. Cooper** is a staff physicist at the Lawrence Radiation Laboratory at the University of California at Berkeley. His area of research is in controlled thermonuclear fusion with particular emphasis on radiations from plasmas and ion source design.

Our class now has two more names to add to its ever growing roster of lawyers. **Thomas Hooker** has opened his own patent law office in Harrisburg, Pa. Tom writes "after leaving Tech I received my law degree from the University of Michigan Law School and then practiced patent law in Detroit until April 1970. Things are going pretty well in Harrisburg. Betty and I look forward to moving into an ancient stone farmhouse very soon. Our two sons, Bob 8½ and David 4, will have a ball learning about barns, streams, cattle and all those things which are missing when childhood is spent in suburbia." . . . **Siegmar Silber** was graduated from Fordham Law School in 1970 and was admitted to the New Jersey Bar. He has joined R.C.A. Corporation's patent offices in Princeton, N. J. The Silbers now have three children, Rachel 9, David 6, and Miriam 1.



Elizabeth and **Robert Ricci** sent a birth announcement of their second child, a daughter, Ann Elizabeth in January. She joins her two-year-old sister, Linda Marie, and her parents in their Bedford, Mass., home. Bob is now chief of the Computer and Display Systems Branch at the U.S. Department of Transportation Systems Center in Cambridge, Mass. . . . A brief note from **Vic Klemas** arrived: "My group at G.E. has entered the environmental field by developing several air and water pollution monitors. I have been elected to the Board of Directors of Ocean Energy, Inc., located in Pittsburgh. During my spare time I am teaching at Penn State and consulting to several universities on remote sensing techniques. And, most important, our third son, Thomas, has just recently arrived.—**Michael E. Brose**, Secretary, 199 Sudbury Rd., Concord, Mass.; **Antonia D. Schuman**, Assistant Secretary, 22400 Napa Street, Canoga Park, Calif.

## 60

**George Schnabel** is now superintendent of the Development Department at Rohm & Haas' Philadelphia plant: he is living in Radnor, Pa., with his wife and two daughters. . . . **Harold Parmelee** has been named chief estimating engineer for the Turner Construction Company in Boston; he's living in Needham . . . **John Hartung** has been named manager of business planning for ITT Rayonier, Inc., the forest products manufacturing subsidiary of ITT; John has been with the company since 1968 as assistant to the senior vice president with responsibilities in budgeting, forecasting and business planning.

**George Walsh**, who is manager of ocean systems engineering at Raytheon's Submarine Signal Division in Portsmouth, R.I., is an inventor; he has had a patent assigned for an acoustic mapping apparatus. It can be used to determine topographic features of the ocean bottom from a ship moving over the surface. For those of you who are interested, the patent number is 3,484,737. . . . **Ronald Burde** has been promoted to assistant professor of ophthalmology at the Washington University School of Medicine in St. Louis. . . . **Richard de Neufville** is now director of the Civil Engineering Systems Laboratory at M.I.T. . . . The Plastics Department of General Electric in Pittsfield, Mass., has announced the promotion of **Gary Gibson** to manager of business planning for the department's business development and planning section.

**Sanford Miller** has been promoted to Professor of Nutrition and Food Science at M.I.T.; and also at M.I.T., **Sheila Widnall** has been promoted to Associate Professor of Aeronautics and Astronautics. . . . And, to wind up all the press releases, etc., **Alan Krigman** and **John Hughes** have been awarded certificates of appreciation for their outstanding efforts on behalf of the 1970 M.I.T. Alumni Fund.

**Sue Schur**, **Chris Sprague**, **Ed Neild**, and **Harry Forster** have been awarded Presidential Citations by M.I.T. for "Contributions in initiating and implementing a new and imaginative program of Seminars for Young Alumni."

Now, back to cards and letters. **Mike Rosner** is "practicing internal medicine in Holyoke, Mass. Joan, our two boys (Jordan and Douglas) and I are eagerly awaiting the ski season." . . . **Tom Lynch** reports that he was married in 1961, has three sons (ages 5, 7, and 8) and is purchasing agent for the Cookson Co. in San Francisco (I assume that's what SF means) a company which manufactures industrial rolling doors.

**Walter Crewson** says that he is "one of the proud founders of a new business in La Jolla, Calif.—Pulsar Associates, Inc.—electronic systems design, specialists in high voltage equipment, accelerators, x-ray machines and lightning simulators." . . . **Lawrence Kravitz** reported to the U.S. army in Vietnam in November; his wife is teaching in her home town, Aberdeen, Md. . . . More military news: Captain **Marshall Douglas Nelson** (Doug when I knew him) is now assigned to Ramstein Air Base in Germany as a Communications Systems Staff Officer for 17 AF HQ (I'm quoting him). Also quoting him, "Old friends are welcome." . . . **Al MacLaren** is assigned to the ABRES (Advanced Ballistic Reentry Systems) Program Office at the Space and Missile Systems Organization (SAMSO) at Norton AFB, California. "I am the project officer for the Terminal Radiation Program (TRAP) aircraft operated by Avco Everett Research Laboratory for the Air Force. Very interesting work in optical reentry phenomena. I'm also working on a joint program with the Army's Advanced Ballistic Missile Defense Agency involving an advanced sensor to be installed on one of the TRAP aircraft."

**Harold Levy** writes: "I have been employed for the past nine years by Searle Medidata, Inc., and predecessor companies. SMI manufactures automated multiphasic health testing systems, and I am Manager of Computer Program Development. Our home life centers around our two children—Erica (3 years) and Peter (1 year) and our home in Belmont, Mass." . . . That's all for now. Send your exciting chapter of the suspense-laden saga of '60 versus the world to—**Linda G. Sprague** 10 Acorn St., Cambridge, Mass. 02139

## 61

I trust you have all read the material Jerry Grossman sent you and are properly enthusiastic about a visit to Cambridge this spring. To keep costs in line you will be able to stay in the new MacGregor hall for nothing over the weekend. If you would like to look up classmates in the Boston area I can forward their addresses to you. Perhaps you can get a couple of beds from them. Baby sitting will be available in MacGregor.

The athletic facilities at the Institute will also be available. We are looking around for a country club which will put up with you duffers. Right now (in January) the location of the Saturday night supper is still vague. Some people favor exotic locals such as the frozen food aisle of the Memorial Drive Stop and Shop or perhaps the bleachers in Fenway park. Other more conservative sorts favor the Sala de Puerto Rico or the Fenway Cambridge. In any event costs will be kept as low as possible. On Sunday we will all go up to Ipswich for a Cape Ann clambake at Castle Hill—a fantastic old mansion overlooking Crane's Beach. The group working with Jerry is making this reunion a pleasant weekend around the new M.I.T. and Boston that won't cost you a bundle. Come back to the Institute; meet some old friends, make some new ones—June 4, 5, and 6.

### Faculty Notes

Part of the M.I.T. scenery are several new Associate Profs: **Jerry Milgram** in Naval Engineering, **Don Nelsen** in Electrical Engineering and **Dave Ness** at the Sloan School. **Dick Naylor** is teaching Earth and Planetary Science but lives over in Boston as faculty resident at Burton in Exile. . . . Farther west at the U. of Mass. **John Ritter** has "become involved in several projects designed to increase the minority student enrollment in engineering at the university." He goes on to say "by spring I will know whether or not they will be funded—at this point I am optimistic about the chances." Good luck John. . . . **Robert Abrams** is an Assistant Professor in Industrial Engineering and Management Science at Northwestern University in Evanston, Ill. . . . **Dewey Ryu** taught a course in Biochemical Engineering for the Organization of American States throughout Latin America. He says it was "a very rewarding and satisfying experience."

And on the other side of the podium. . . . **Peter Gaposhkin** is at Berkeley finishing up a Ph.D. in physics. He has been gathering degrees at Cal. since 1965 (M.A., astronomy) and 1966 (M.A., physics). . . . **Marshall Greenspan** is a Ph.D. in engineering and has his first patent—a system for aligning remote lines of position (it says here).

### Honest Laborers

**Jim Knoedler** writes that he is "still surviving with TRW in Houston after a pretty hard year in aerospace. Britta and I had our second child—a daughter, Alicia, last April 21. That date makes her a real Texan since the 21st is Texas Independence Day." . . . **Walter Freeman** is a senior traffic engineer with Edwards and Kelsey and has been involved with something called TOPICS projects for the last year. . . . **Charles Arcand** says, "since January '70 I have been with Mohasco Industries in Amsterdam, N.Y., doing research on flame retardancy. I'm also going for a Masters in business administration with a major in finance at SUNYA (State University of

New York at Albany). Our son Alan is 15 months old and a veritable tiger; my wife Bernadette is expecting a second child in July." . . . The word from **Paul Fricke**: "I am currently an investment officer with the Chicago Title and Trust Co., specializing in the health care field. The M.I.T. Club of Chicago has drafted me as treasurer the last two years and I've also been an Educational Councilor for M.I.T. I highly recommend the latter for rebuilding faith in 'youth.' Of the sixty-one-ers I've seen over the last year or so, **Hank Wagner** (N.J.), **Fred Carson** (D.C.) and **Al Klancnick** (Chicago) all seem to be prospering." Thanks for the news, Paul. . . . **Bob Pease** writes: "I have been working on all sorts of challenging and interesting projects in Analogue-to Digital and D-A conversion as a staff engineer at Teledyne Phylbrick Nexus. (The name gets longer every time I hear from Bob.) I'm also doing a lot of hiking with my family, including Benjamin (6) and Jonathan (3)—a good little hiker." . . . **Richard Mezger** is an assistant treasurer at the State Street Bank in Boston. He is managing a group of computer programmer/analysts who are developing an on-line mutual funds shareholder accounting system. His wife, Sue, is a student in ceramics at the Mass. College of Art. . . . **Stuart Lichtman** is director of market planning at Recognition Equipment Inc.

Thus far it has been a lovely winter in Boston with record snowfalls in December, making for terrific skiing over the holidays and a chilly period in early January making for excellent skating on the Charles up near Harvard. My wife Helen called the authorities about the safety of the ice and they claimed that although it was four inches thick there were pockets of pollution here and there which weakened the ice. (We went anyhow.) So the Charles will be as you remembered it when you return this June. Mark the date: June 4, 5, and 6. See you then.—**Andrew Braun**, Secretary, 464 Heath Street, Brookline, Mass. 02167

## 62

Greetings from sunny Southern California. This article is being written in the midst of a heat wave and with temperatures soaring to 95 degrees, a tan is not too difficult to acquire.

**Eugene Finkin** took an excursion in April—to the altar, that is—and married Lillian Weiss. Lillian is a Smith alumna, class of '64. Congratulations to both of them. . . . **Charles Martin** continues as a group leader with Raytheon in Wayland, Mass., concentrating on hybrid control systems and A/D-D/A converters. In addition to their daughter, Amy, 5, they announced the arrival of Jonathan in September. . . . On the international scene, **B. T. Tucker** has joined Arthur D. Little, Inc. in Brussels, Belgium. . . . **Rudolph Gawron** has assumed a new position as senior systems designer with the integrated circuit department of General Electric in Syracuse, N.Y. He

and his wife, Jean, were expecting their first child in January. . . . **Dr. Fred Gilbert** is devoting his efforts to neurobiology, presently working in the Laboratory of Biochemical Genetics at the National Institute of Health in Bethesda, Md. . . . **Jon Zellers** is presently affiliated with a well-known organization, the U.S. Marine Corps. Jon is attending Amphibious Warfare School in Quantico, Va. . . . Traveling a fair amount around the western U.S. for Kennicott Explorations, Inc., keeps **Phil Nelson** occupied. Phil and his wife have one son, Erik, now a year old and are expecting their second child in May. . . . Recently named vice president of Urban Investment and Development Co. in Chicago was **Marvin Richman**. Marv received his master's degree in city planning from N.Y.U. and lectured at that institution for two years on planning at the Graduate School of Public Administration. Under a State Department fellowship, he studied architecture in Chile. For Urban Investment, Marv will be director of development for River Oaks West, a planned community in the Chicago area.

As mentioned previously, **John Prussing's** name appears quite frequently in *Technology Review*. However, I did not expect to see his name again in print this soon. John was erroneously reported to be in the San Francisco area. Rather, he is an assistant professor at the University of Illinois teaching in the aeronautical and astronautical engineering department. John's field is optimal control theory and orbital mechanics. His wife, Laurel, is also at the U. of I., but in a different capacity. She is working toward her Ph.D. in economics and in her "free time" keeps busy analyzing economic aspects of cleaning up the environment, trying to enact legislation that will ban non-returnable bottles. Laurel's argument is that the disposal of throw-aways is a public subsidy as well as being a waste of resources. . . . One Sigma Nu who is in the Bay Area is **Brandy Qualls**, M.D. Brandy is completing his internship in that city and is planning to serve his residency in psychiatry at Stanford next year.—**Gerald L. Katell**, Secretary, 122 North Maple Dr., Beverly Hills, Calif. 90210

## 63

**Jerry Glaser** is at Bell Telephone Labs in Murray Hill working on a millimeter waveguide communications system. . . . **Robert Petrich** reports that he is now back at Rohm and Haas after getting a Ph.D. in Polymer Science from the University of Akron in December of 1968. He is a group leader in plastics research.

**Michael Platt** writes, "In April I left General Foods, where I was a Product Manager, to join Pangener Marketing, Inc., a direct response marketing organization. . . . **Kenneth Klein** is in propulsion engineering at Grumman Aerospace Corporation.

**Tom Anderson** spent over three years at

Boeing in Seattle after receiving his master's in civil engineering from the University of Washington. He is now in project engineering at Concrete Technology Corp., Tacoma, Wash. In May of 1970, Tom married Kathryn Ford of Tacoma. . . . **Howard Leibowitz** is working for Corning Glass Works, Corning, N.Y., in process engineering. He has a wife, the former Sally Bennett, and three children Linda, Heidi, and Jill ranging from almost six years to three years. They all live on RD #1, Big Flats, N.Y.

**Jim Burke** is responsible for operations research at the Sperry and Hutchinson Co. . . . **Jim Hufford** is back in the Boston area after three years in the mid-west. His family consists of a daughter age three and a son age one. Jim is taking courses at Tech and is responsible for engineering at the Icon Corporation which works in numerical control.

### Philadelphia Lawyers

**Donald K. Joseph** is practicing law with the firm of Wolf, Block, Schorr and Solis-Cohen in Philadelphia. . . . **Dan Ross** is also practicing tax law in Philadelphia after a stint in Vietnam with the army.

### Academia

**Peter Mlynaryk** is working on his dissertation at U.S.C. and teaching at California State College, Fullerton, where he is Assistant Professor of Finance. . . . **Patrick E. O'Neil** is Assistant Professor at the Institute in computer science. He received his Ph.D. under Professor Rota at Rockefeller University in 68 after working at I.B.M. for two years. He is married to **Elizabeth (Betty) Hallalso** of our Class. (The preceding makes a mess of statistics on who receives *Technology Review* as Patrick is listed as receiving it and Betty is not. It appears we will have to keep up with who is living with whom.) . . . **Stuart Solin** is Assistant Professor of Physics at the University of Chicago having received his Ph.D. from Purdue in October of 1969. His wife Eileen (Chernock) was expecting a second child. They have one daughter Beth 17 months. . . . **Alan Schwartz** received a Ph.D. in mathematics from Wisconsin in 1968 and is now on the faculty at the University of Missouri at St. Louis. He was married in June of 1965 and has one daughter. . . . **Dale Miller** is in pursuit of a Ph.D. in E.E. at Berkeley working in high vacuum technology in electron microscopy. He was planning a visit with his wife's parents in Norway.

### More Ph.D.'s

**Alan Schindler** received a Ph.D. from Brandeis in physics in June of 1968 and his wife Barbara received an M.D. from Woman's Medical College of Pennsylvania in June of 1970. They have one daughter Rebecca age one. . . . **Charles Wende** finished his Ph.D. in physics in August of 1968 at the University of Iowa where he was working with space physics as he is now at N.A.S.A. in Maryland. He claims he has become suburbanized complete with dog.



We have news from several other Classmates this month. **David Caskey** writes the following: "after getting my M.S. from M.I.T. in '64, I spent five years with Sandia Laboratories in Albuquerque, N.M. (contrary to popular opinion this is in the U.S.A.). However, I am currently on leave from Sandia and attending the University of Texas at Austin. I have completed one year, and with a little help from my wife and not too much hindrance from our two-year-old daughter, Laura, we may finish in two more. Thereafter, as dedicated New Mexicans, we expect to return to Albuquerque." . . . **John R. Brach** writes that since his last note he has a son, Brian, born in October 1969 and a new home in Fairfax, Va. He claims, "I'm still making Sverdrup and Parcel Consulting Engineers rich as Resident Engineer in Washington, D.C.—**Martin Schrage**, Secretary, 305 Massachusetts Ave., Arlington, Mass. 02174

## 64

The approach of spring has brought a number of Class Heroes (defined as anyone who writes me a letter direct) out of the winter's news freeze (defined as total reliance on alumni news clippings). One of these is **Ed Casper**, who also sent me a Christmas card last December. Ed reports that he put on a one-man show recently at the New Britain Memorial Hospital (Conn.) where he played the piano and told a few jokes.

Another Class Hero is **John Meriwether**, who is conducting barium release experiments for the Goddard Space Flight Center. The experiments are being performed in northern Canada and the north slope of Alaska, where the temperature is sometimes  $-50^{\circ}$ . John has a Ph.D., lacks a Mrs., and is the proud bearer of a private pilot's license.

Still another Class Hero is **Gary Walpert**, who graduated from Harvard Law School last June and is now working for the patent law firm of Fisk & Richardson in Boston. His wife Ellen is in her second year at Boston University Law School. . . . I also received Christmas cards from Sherry and **Bob Scott** and Deanna and **Robert St. Aubin**. Robert notes that he is still with the legal department of American Viscose Corp., in Philadelphia.

And now for news of others—**Charles Abzug's** wife Zipora gave birth to a girl last September 9. Zipora is an Israeli microbiologist who has been working on the generation of acoustical signals of large amplitude. . . . **David Bivins** is working for Mathematics, Inc., in Princeton, N.J., which he joined after receiving his Ph.D. in operations research from M.I.T. in September of 1969. He and his wife Bonnie spent 6 months on assignment in northern Italy, and in October of last year became the proud parents of David, Jr. David, Sr., notes that net income (income-outgo) is still not diverging from zero! . . . **Richard Carpenter** and his wife Joanne have left apartment living for a

home in Hingham, Mass. He is continuing to do consulting with Index Systems, Inc., and hopes to complete his Ph.D. at M.I.T. this spring. . . . **Jerry Dassel** received his Ph.D. in metallurgical engineering at Purdue in 1969, and is now employed at Kaiser Aluminum Center for Technology in Pleasanton, Calif. His wife Jerilynn graduated from Pomona in 1965. . . . **Eric Greenwell** is living in Washington State and enjoying car racing (he had two seconds and a third this season) and skiing. . . . **Larry Langdon** is teaching math at Virginia Union University. . . . **Ronald Lawson** and his wife Jane are preparing for an 18-month stay in England. They both work for MITRE Corp. and are being transferred this July. . . . A cryptic note from **Karen Loomis** (Mrs.) says she arrived Women's Lib Day (August 26). . . . **John Ludutsky** was married to the former Jouse Prins in New York last April. . . . **Peter Ordehook** has been promoted to associate professor of political science at Carnegie-Mellon University. He is in the final stages of writing a book, *Analytic Democratic Theory*, which is scheduled for publication in early 1972. . . . **Joseph Perkinson** is working for Raytheon as a research and development section head.

**Robert Popadic** is married, is with the State Street Bank in Boston, and enjoys sailing. He reports seeing **Steve Miller** last October in Los Angeles, where Steve is bacheloring it on the beach and driving an orange Corvette. . . . **Mark Schoenberg** is studying muscle contraction at the National Institute of Health.

**Jay Tenenbaum** received his Ph.D. in E.E. at Stanford last October. After celebrating with a two-month trip through Europe and Israel, he returned to work in the research division of Lockheed. . . . **Phillip Townsend** now has a second daughter, Jennifer, born last August. He is working on developing new petrochemical ventures for Shell Chemical.

**Jerome Weiner** and his wife spent last summer touring the Far East. . . . **Albert Zobrist** is an assistant professor of electrical engineering and computer science at the University of Southern California. . . . Let me hear from you.—**Ron Gilman**, Secretary, 5209 Peg Lane, Memphis, Tenn. 38117

## 65

This column is due to appear in the first issue of spring. That is an encouraging thought at the moment as the Boston temperature is ten degrees with a chill factor of thirty below. Does anyone have any theories about new ice ages?

### Degrees and Things

**Dick Amster** has completed Suffolk University Law School, passed the bar exam and been admitted to the Massachusetts Bar. Dick has been working at Raytheon on the A.B.M. for the last five years and spent the summer on Kwajulien. . . . **Stanley Brown** has completed his D.Eng. at Dartmouth and is now a Postdoctoral

Fellow at Dartmouth Medical School. His research is on neurological control of respiration in the cerebral cortex of cats. Stan was married on November 28, to the former Miss Katharine Merritt of Easton, Conn. She is Assistant Professor of Microbiology at Dartmouth Medical School and a graduate of Vassar and the University of Michigan. . . . **Robert P. H. Chang** received his Ph.D. in Astrophysics from Princeton last September. Also in September, **James Hartman** received his Ph.D. in operations research from Case Western Reserve.

Some of our classmates are now returning to school to start the path toward advanced degrees. **Charles McBride** has returned to M.I.T. to pursue a Ph.D. in operations research, and **Jon Shinno** has started full-time at the University of Southern California Law School.

**Edwin Kampmann** is in graduate school at Berkeley doing a dissertation on design and evaluation of overall solid-waste management systems for an urban county. He is still active in out-of-doors back-country excursions of various kinds.

**Stanley Wulf** is finishing his Ph.D. thesis in materials science at Northwestern, doing research on glass reinforced polymers. Stan was married on December 19, 1970, to the former Julie Gay Idoine, a graduate of Northwestern in music. . . . **David Johnson** is a graduate student in marine geology at Scripps Institution of Oceanography in San Diego. In November he presented a paper on sea-floor erosion at Interoccean '70, a conference in Dusseldorf, Germany.

### Jobs—Old and New

**Willard Welch** started work as a staff chemist with Pfizer in June, after a one-year postdoctoral fellowship at Berkeley. Willard reports the birth of a daughter, Melissa Jeannette on July 18, 1970. . . . **Stephen Scott** is working with Inland Steel in Chicago on the development and implementation of a corporate financial simulation. . . . **Cassius Peacock** is working at Millipore Corporation in Bedford, Mass., as a production and inventory control system designer. Cash was best man at Stan Wulf's wedding. . . . **George Lee** is working for TRW Systems in Redondo Beach, Calif. George is supervisor of the Package Design Group and works on automated printed circuit board design.

**David Disher** is working as a consultant in geophysical research and programming and published an article, "Statistical Automatic Statics Analysis," in *Geophysics*. . . . **Edward Yourdon** is an independent consultant in computer systems and teaches the Control Data Institute for Advanced Technology course on advanced computer techniques. . . . **Bruce Zotter** is at the GE Knolls Atomic Power Laboratory in Schenectady and reports that Admiral Rickover has been a good provider during this lean time for engineers. Bruce is taking geology courses and applying for his Professional Engineer's license. . . . **Karl Kehler** reports he is Manager of Strategic Planning

In the Manufacturing R&D Activity of the Equipment Group of Texas Instruments.

**James Bochnowski** is now with Donaldson, Lufkin & Jenrette, an investment firm, as a securities analyst of technology companies. After two years in the army, Jim attended the Harvard Business School and received his M.B.A. in 1969. —**Steve Lipner**, Secretary, 940 Belmont St., Watertown, Mass. 01272

## 66

The Ph.D.'s just keep rolling out of the Halls of Academia. This trend doesn't seem to stop at all, but merely gets heavier as the months roll by. **Damian Kulash** completed his Ph.D. in civil engineering (transportation systems) in November and has moved to Washington, D.C. to work for the Urban Institute.

**Jack Fuhrer** received his E.E. degree in February and is now working for the R.C.A. Labs in Princeton, N.J. He and Susie are finally in their own house, and they enjoy living "as human beings—as opposed to students." They see a lot of Judy and **Scott Keneman** who has been at the Labs since 1966. . . . **Mike Weisfield** finished a Ph.D. in chemistry and is now on a post-doctoral fellowship at Carnegie-Mellon University. . . . **Stu Spitzer** has finished his Ph.D. work in October and received the Ph.D. degree in the February ceremonies. He is at the Bell Labs in Murray Hill, N.J. He and his wife Ronda have bought a house in nearby Berkeley Heights. . . . The final doctorate we have news of this month belongs to **Bill Nelson** with a Ph.D. in solid state science at Princeton. He has joined the faculty at Lehigh as a lecturer in physics.

The medical field continues to add members of our class to their ranks. **Joe Adolph** graduated from medical school this past spring and is living in New Haven while doing a surgical internship at Yale-New Haven Hospital. Three others also at Yale-New Haven are **Dan Dedrick**, **Chuck Davis**, and **Calixto Romero**. Calixto lives in West Haven with his wife Lissette and a 15-month-old daughter Laura. He will begin a residency in internal medicine at the University of Chicago Hospital next July.

Raw material for future issues of the Class of 1966 column are the following who are still grinding away at the academic wheel. **Hans Bozler** is working for his Ph.D. in physics at Stony Brook. . . . **Leon Russo** became disillusioned with research in physics and spent a year in the Computer Science Department at the University of Pennsylvania. Finally, he saw the light and is now engaged in a thesis in electro-optics in the electrical engineering department. . . . Since graduation from M.I.T., **Ken Estridge** received a master's degree from the Sloan School in 1968 and is now involved in finishing his doctorate in finance at the Harvard Business School. His thesis

concerns itself with the design and implementation of a fully-interactive computer-analyst portfolio management system. Last year he worked as a portfolio manager for Fred Alger & Co., New York. Ken's "alive, single, and well."

A letter from **Larry King** this week reveals that the U.S. Air Force is obtaining his services for the last time on May 27. Plans call for a trip to Israel and a 3-year contract for an Israeli aircraft company. He, Jenny, and Jan (Larry, daughter, and wife, respectively) spent the Christmas holidays in Los Angeles where his parents live and managed to see the Rose Bowl Parade. . . . A telephone conversation with **Jim Sweeney** informed me that he is almost done with a Ph.D. in economics at Stanford. When he finishes this spring, he will stay there as an assistant professor in economics. His work is in the dynamics of the urban housing market. . . . **Don Haney** has been a first lieutenant in the Air Force since January, 1970, at Kirkland Air Force Base, New Mexico. For two and a half weeks in December, he attended an Air Force Weapons Employment and Planning School at Maxwell Air Force Base. His wife Mary is completing a Ph.D. in engineering management at Clemson University and is vice president of a new land development corporation in Albuquerque. . . . **John Golden** has established a consulting business dealing with computer system problems of industry. A third child, John, joined Elizabeth and Jennifer on April 17, 1970. The Goldenes live in Needham, Mass. . . . **Tom Brylawski** is now an assistant professor of mathematics. He, wife Joan, and son David (two years) live in Chapel Hill, N.C.

**Rich Lucy** is living in Manhattan Beach, Calif., and working on the Spartan program for McDonnell Douglas. He teaches scuba diving on the side. He regularly bumps into **Ralph Schmitt**, **Jack Mazola**, his neighbor **John Flick**, and **Rob Taylor** who just was transferred to Paris for Xerox Data Systems. Not bad! . . . **Mark Schwartz** is completing his first year as a medicinal chemist for Smith, Kline, and French. He plans to return to graduate school in September to finish work for his doctorate in chemistry.

**Joe Blew** is now married to a Smith grad, Carol Holliday '68. They live in Washington, D.C., where Joe is a project architect with Harry Weese & Associates, consultants on the D.C. metropolitan rapid rail system. . . . **Mike Adler** works for the operations research department of Ciba-Geigy Corp. in Ardsley, N.Y. Because he is doing the same type of work he did for his previous (defense) contractor, his draft board let him keep his 2A. "I guess they just gave up trying to get me." . . . Now for the unusual report of the month: **Bob Marsh** and his actress/model wife Carole are in Tempe, Ariz., where Bob is a memory systems architect at Vermont Research Corp. Bob left M.I.T. before its riots, but he and Carole appeared as rioters in MGM's student strike film "Strawberry State-

ment." It was filmed in San Francisco, where they lived last year. . . . Cheers!—**Terry J. Vander Werff** Secretary, 2049 Manchester Dr., Fort Collins, Colo. 80521

## 67

**Roger Kirst** writes that he passed the Bar and will soon be a New York lawyer. Last August he married the former Helga Leukert. He is planning to begin four years of JAG duty when he completes two months of study at the Navy Justice School in Newport. . . . **Jim Foster**, having graduated from Harvard Law School, is working for the New York City law firm of Cahill, Gordon, Sonnett, Reindel, and Ohl. He is still single. . . . **Travis Gamble** picked up hepatitis and mono while traveling in Australia and New Zealand and has been recovering at his home in Birmingham, Ala. . . . Jim and **Dianne Pickering Maar** have purchased a house in the new city of Columbia, Md. . . . **John Reynolds** was discharged from the U.S. Army in July as a first lieutenant. He received an Army Commendation Medal for his work with the USASA Material Support Command in Warrenton, Va. John is in a management development program for N.Y. Telephone Company. . . . **Herbert Schulze** will soon enter active duty in the air force. Having graduated from University of Chicago Law School, he is awaiting the results of the California Bar Exam. . . . **Garland Taylor** is serving in Yokosuka, Japan, and playing on the Yokosuka Seahawk Team in the Interservice Football League. . . . **Paul Tarantino** is with a U.S. Navy anti-submarine patrol based at Moffett Field, Calif. He recently began a six-month deployment to Adak, Alaska, and Guam. Naturally, he plans to do a lot of reading.

**Greg Zacharias** is still with the air force and NASA in Houston. His wife Susan is teaching at Alvin Junior College. . . . **Bob Katz** says that everything written in the *Review* concerning him has had a fifty per cent accuracy. Not bad. He is actually responsible for graphics marketing development for Digital Equipment. . . . **Danilo Santini** is studying City and Regional Planning at Illinois Tech while his wife Tomma, a psychiatric nurse, supports him. . . . The army will soon allow the departure of **Larry Aronberg**; he has a job in Vietnam with the largest military club system in the world. His rank is Sp/5. . . . **Tom Brownscombe** is in Houston doing work on computer applications to organic synthesis and enjoying the particulate-free effluvia that passes for air. . . . **John Ebert** and **Mike Zuteck** had one of those tragi-comic experiences last summer as they tried to motorcycle from Houston to Phoenix. They were slowed by inexperience, a scrape with the law, and lots of rain, and a bad puncture finally finished them off. They did have an enjoyable reunion with classmates **Tim Kjellberg**, **Al Gammon**, **Jim Warniak** and **Greg Wight**, after reaching Phoenix by air. . . . **June Maul** is teaching science in high school and getting a masters in science and education at Fairleigh Dickinson University.



**Guillermo Arnaud** is stationed at Ft. Ord, Calif., while working in an organization known as USACDCEC and performing quasi-electrical engineering duties (more quasi than anything). He wishes that he had the courage of **Paul Greene** . . . **Larry Galpin** is still with Dupont in Wilmington. His free time is occupied by his M.B.A. studies, soccer, and tennis. He would like to hear from classmates. . . . **Warren Belfer** received his M.S.E.E. in June from University of Illinois at Champaign. He is working for the Army Weapons Command as a fire control systems engineer. . . . **Robert Baker** recently put together a one-man photography show at the Newton Free Library. He spent two weeks in classrooms and caught youngsters building with blocks, shaping clay, finger-painting, reading, and jumping rope. Bob free lances and teaches creative photography at the Art Institute of Boston. . . . **Constance** and **Jacob Bernstein** have had a busy year with their first child, Aaron Jason. They want Monk to drop a line to 53 University Rd., Brookline.

Janice and **Mel Snyder** and **Roy Gamse** tried to communicate with **Spence Sherman** on January 9 as per the directions given in this column in December. Unfortunately, they could not get an open line, but they did manage to talk to **Neal Gilman** on a party line. Neal is currently a lacrosse star in Northern California.

**Larry Constantine** has become increasingly involved in family life education; he recently completed a rather innovative filmstrip for a major publisher of high school material. The Constantines expect a second child in May. . . . **John Podolsky** is with Xerox Data Systems in Los Angeles. . . . **Bill Murray** has had enough of California and has returned to graduate studies in Ann Arbor. . . . **Tom McCarthy** is working for Univac in Roseville, Minn. . . . Last summer **Robert Sarly** completed the master's course in city planning at the Technion in Haifa; he has since gone to the University College in London to do a Ph.D. in new towns planning. His dissertation is entitled "The Economic Evaluation of Urban Form in British New Towns."—**Jim Swanson** Secretary, 774 Channing Ave., Palo Alto, Calif. 94301

# 68

Alas the scenic Charles is now frozen as I write this. It hasn't been above freezing in Cambridge for a week now, however a "warm spell" is expected any day now, i.e. it may get above freezing. But I just imagine how bored **Sanford Kornfeld** must be living in the Virgin Islands with all that warm weather. Actually things were getting pretty desperate this month with material for the Class Notes. A ray of hope was a long note we received from Nancy Griswold, wife of **Thomas Griswold**. They were married on June 10, 1967 and are now living in Lexington, Ky., where Tom is doing graduate work at the University

of Kentucky Geology Department under Dr. William Dinnen, '42, and Dr. William Blackburn. He passed his qualifiers in May, received his M.S. in December, and is now doing a thesis on rocks. As a result of some rock samples he collected in Nova Scotia in the summer of 1967 with Dr. Blackburn, he has six publications to his credit, which Nancy describes as "pretty good!" She received a B.S. in home ec from Wisconsin in 1967 and is a T.A. in the Department of Textiles at Kentucky. They are the proud owners of two dogs—a one-year-old St. Bernard and an eight-month-old red Doberman pinscher.

**Eric Schuetz** and his wife, Cecile, are presently living in Lenox, Mass., while he is working in Pittsfield for G.E. on the Manufacturing Management Program. They had previously spent a year in Schenectady on the same program. Eric hopes to go to business school in September. . . . In July, **Stephen Osheroff** returned from a year as a teacher with the Peace Corps in Grenada, West Indies. He now works for the New Jersey Department of Higher Education as a program evaluation officer.

The following three classmates have recently reported address changes to "APO San Francisco" and therefore it may be said with high probability that they are in Vietnam: **Thomas James, Victor Blanco, and John Duncanson**. . . . I was discussing with some friends the other day the various methods, some legal, some not, for avoiding the armed forces if one is so inclined. We've printed things from people who have refused induction, completed alternative service as a C.O., and served in the Public Health Service. Is there anyone in the class who has thwarted the Army by serving in the Coast and Geodetic Survey? If so we'd be glad to hear from you and print your story, along with all other stories and comments (of reasonable size) on this topic of much interest.—**Gail and Mike Marcus**, Class Secretaries, Eastgate Apt. 16A, 60 Wadsworth St., Cambridge, Mass. 02142

# 69

The task of writing this monthly column can become most difficult (or perhaps easiest for me) when I don't have any material or information to include in it. When **Bruce G. Leslie** noticed that I had missed the January issue, he sent me the following letter which I reprint here for your entertainment and enlightenment.

"Last night my monthly *Tech Review* arrived and I thumbed eagerly to the last page to see what my classmates were up to. Apparently, not much, since the magazine ended with Gail and Mike Marcus. 'What's the matter with that secretary of ours?' I thought. 'Who the hell is he anyway?' Suddenly a small blue dwarf emerged from my bedroom and pointed his finger accusingly. I guess you need news, huh? Well, here's my first installment.

"Two days after graduation I arrived eagerly in Pittsburgh to join Westinghouse. After shaving my beard and going straight for six months to fool both my boss and the draft board, I quit in frustration and discovered I had enough money to survive a while without getting up in the morning. Then, while debating once again the draft, the FANTASTIC lottery came along and bestowed upon my birthdate the number 317. I stopped looking for defense work. In fact, I stopped looking for work entirely and drove to Florida, Mardi Gras, and St. Louis. Eventually, I made it back to Boston (home was then New York) and, while on an excursion to Headquarters East, I ran into my undergraduate advisor, Professor Burke. The rest is history.

"Oh, you didn't major in history? I'll continue. The good professor told me of a job opening at Haystack Observatory, the radiotelescope formerly operated by Lincoln Labs and now a part of the Institute. As an off-shift operator, I still don't have to get up in the morning and no one hassles me about my beard, long hair, or bells. The eight months I've spent there seem shorter than any single month with the M-I Complex. In short, it's a great life. My hours do put a crimp in my woman-chasing style (I'm still single) but any hours at all would put a crimp on my woman-chasing style. After furnishing my apartment and my car, I'm looking for ways to spend money. I think upgrading my stereo is in order. And I think now I can buy a pair of pliers and crush that dwarf. . . ."

I thank Bruce for his letter and hope that the rest of our classmates will realize that the responsibility for writing this column is a joint project between themselves and myself. Send me a note or card when you get the chance or else that blue dwarf may begin to appear in this column.

Finishing "the most educationally rewarding" experience of his five years at M.I.T., **Robert G. McGregor** has just wrapped up ten months of work on the Clean Air Car Race, an inter-university competition in the design and construction of low pollution automotive power plants which was reported to the Army Corps of Engineering in February 1971.

**Mike Gurwitz** and **Mark Feldman**, '72, have captured the first trans-Atlantic bridge competition, a junior pair championship restricted to players under 26. Congratulations to Mike and Mark!

In closing this installment I would like to acknowledge the assistance of Miss Marilyn Eisner, a graduate student in the department of education at Boston University, for her assistance in preparing these notes while I was busy taking mid-year exams. Her name should be familiar to former Baker House residents. . . . Don't forget about that blue dwarf!—**Richard J. Moen**, Secretary-Treasurer, 412 Hastings Hall, Cambridge, Mass. 02138





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# ok, what is a real-time analyzer?

A Real-Time Analyzer (RTA for short) is simply a system that makes on-the-spot analyses from random and irregular electrical signals such as radar echoes or nerve impulses. In fact, signals from any electrical, mechanical, or biological source, detected by the appropriate transducers, can be examined by an RTA. Moreover, the 'smartest' RTA (like T/D's 1923 Analyzer) can aid in the identification of the source of a signal (or any element in the signal) and, because of its speed, can direct almost instantaneous corrective measures.

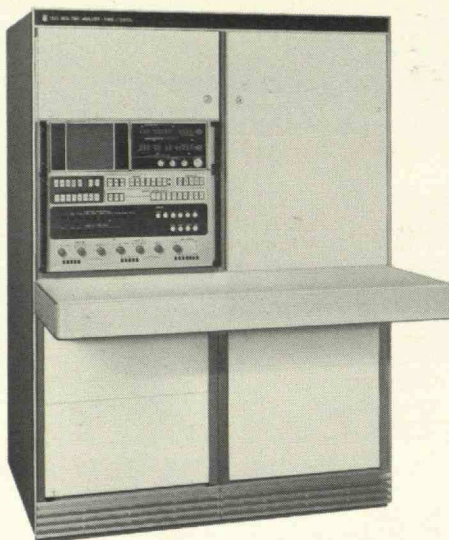
## What does an RTA offer beyond conventional analysis equipment?

In a word — speed! Data from the usual system (a swept spectrum analyzer, for example) often must be examined away from the equipment before any reaction can occur — much too slow a process in critical situations! Consider: The **immediate** detection of an abnormal electrocardiogram can direct emergency medical action to save the life of a cardiac patient. Or, the **immediate** detection of a potential oil source can save as much as six months' delay in drilling and drastically reduce the cost of exploration in remote parts of the world. Many other less dramatic instances exist, of course, but the **immediacy** of reaction is still the forte of the RTA alone.

## What kind of information can I get — and use — from an RTA?

An RTA, by internally performing any of several mathematical operations, can provide useful information — in the form of a scope trace, a printout, or an unseen control signal — about:

- Coherent signals buried in noise. The process of extracting the desired signal is so sensitive that the magnitude of the noise can be up to 100 times that of the hidden signal. Examples include examinations of communications channels and radar ranging.
- The similarity and common characteristics of two apparently dissimilar signals. In the cross-correlation of two such signals, one could be a standard of comparison representing a known normal condition. Geophysical exploration



tions and airframe testing illustrate this kind of data search.

- The identity of acoustic sources and paths, plus data about the transmissibility of materials. Radar, sonar, loudspeakers, and auto-chassis development are fields that come to mind.

The ability of the RTA to keep pace in situations where large quantities of data are generated can effect a substantial cost savings. Using the RTA to test mass-produced items permits 100% testing rather than occasional spot-checks and assures you of the best quality products. It would take many men to equal this level of quality control.

At the other extreme are the limited-data situations you may encounter. An RTA has no difficulty producing accurate data during missile launches, aircraft flyovers, test explosions, or chassis vibrations during engine start-up. Whereas other spectral analyzers are at best cumbersome in analyzing short-term signals (by using tape loops for repeated playbacks of segmented data, for instance), the RTA samples the data at precisely the right instant and includes the proper sample length. Vibrations during engine start-up can be very different from those generated by an idling engine; primary explosion effects can be different from the effects of secondary explosions, etc. At either data extreme, only an RTA can keep up with long-term events or avoid averaging long-term information into short events.

## What kinds of RTA's are available?

General Radio and its subsidiary, Time/Data, produce several different Real-Time Analyzers that cover every performance need. The GR 1921 Analyzer, with its hard-wired processor, provides amplitude-vs-frequency breakdowns of acoustic signals in thirty 1/3-octave bands up to 80 kHz. Custom versions with up to 45 bands, in either 1/10-, 1/3-, or full-octave bandwidths (or mixtures of the three), are available, too.

The T/D 1922, with a digital processor, measures the spectrum density of signals from dc to 20 kHz in bandwidths from 0.05 to 800 Hz. By means of simple pushbutton operations, the 1922's scope displays time-domain data, spectral data, and all measurement parameters.

For the broadest capability in real-time signal analysis, you will want one of the T/D 1923 Analyzers. The three models in this series all utilize the flexibility of a digital computer to give you analyses in the time and frequency domains. In addition to basic spectrum analyses, the 1923's perform operations such as auto correlation, cross correlation, complex multiply, transfer function, convolution, coordinate conversion, coherence function, amplitude histograms, and cepstrum. The 1923A is the fastest and most versatile of the three. The 1923B is only slightly slower, but proportionately less expensive. The 1923C is the lowest-priced analyzer that gives you real-time performance.

With a price range from less than \$10,000 up to \$85,000, there is a GR analyzer for any purpose you have in mind.

## Where can I learn more about Real-Time Analyzers?

The best way to get the exact analyzer you need is by talking to an RTA expert from GR. To get the full story on all the RTA's, the options, and the possible custom variations available, just call one of the telephone numbers listed below or write to: General Radio, 300 Baker Ave., Concord, Massachusetts 01742; Time/Data, 490 San Antonio Rd., Palo Alto, California 94306; or GR/Europe, Postfach 124, CH 8034, Zurich, Switzerland.



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